ELECTRICAL REVIEW

FRIDAY
19 JUNE 1959

WEEKLY
PRICE 1s 6d

"BS.42" Face Mounting

"Gryphon"
Resilient Mounting

"Merlin"
Protected Type

Oil Burner Flange

"Gryphon"
Standard Type

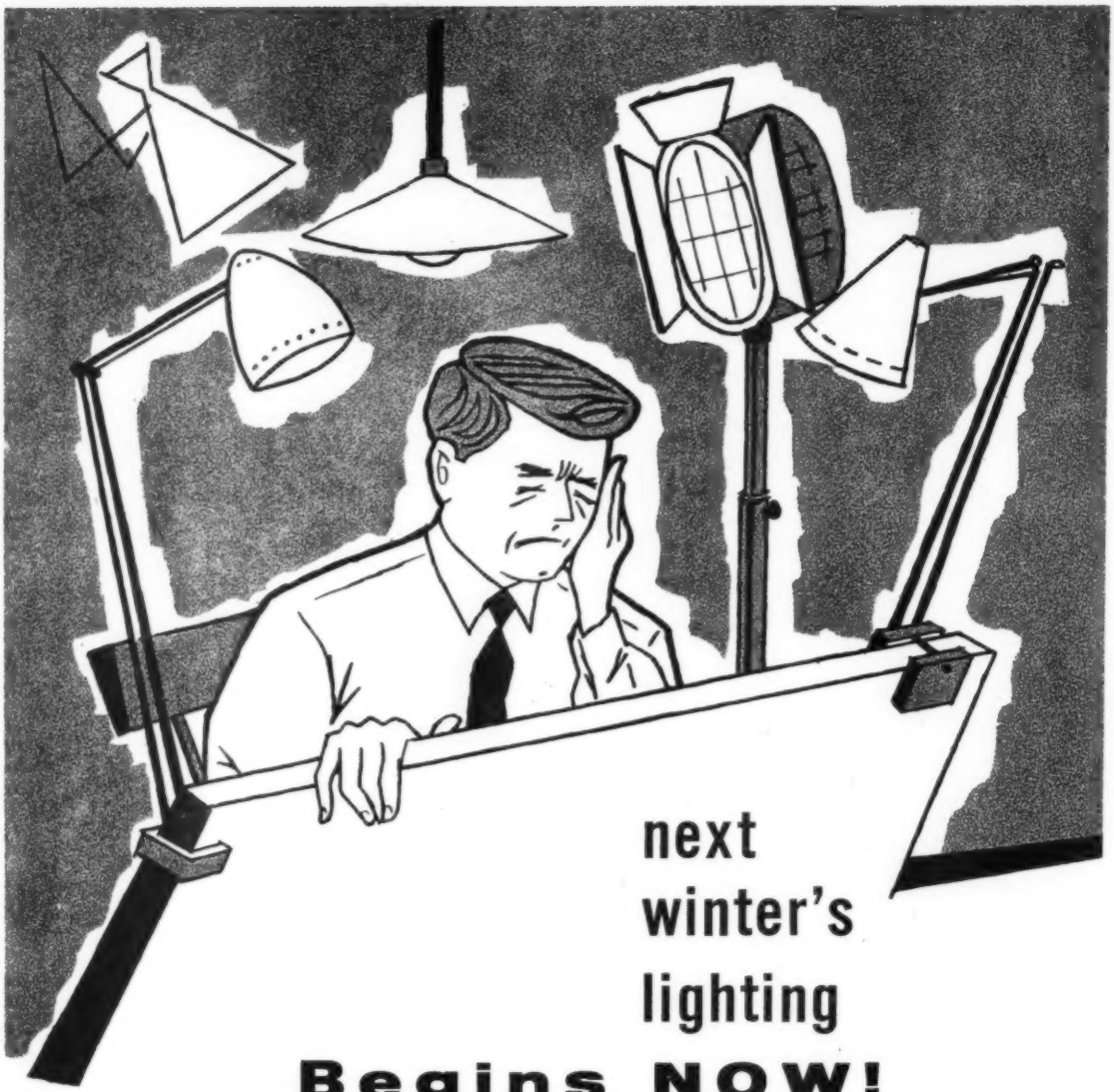
Washing Machine
Type "Merlin"

"BS.42"
Foot Mounting

"BS.42"
Flange Mounting

BROOK
MOTORS
Ltd

FRACTIONAL HORSE POWER
ELECTRIC MOTORS



next winter's lighting

Begins NOW!

Last winter will inevitably have shown up any weaknesses in your customers' lighting, weaknesses that together will have added up to lowered efficiency... lower production.

Now is the time to remind your customers that next winter is only a thought ahead... to awaken them to action so that their lighting will be at top efficiency when winter returns.

Winter lighting can bring YOU summer dividends if you act now.

better lighting by BENJAMIN REG'D.

THE BENJAMIN ELECTRIC LTD · TOTTENHAM · LONDON · N.17

Tel: TOTtenham 5252. Grams: 'Benjalect, Southtot, London'

BIRMINGHAM: 5 Corporation Street, Birmingham 2. *Tel: Midland 5197*

LEEDS: 49 Basinghall Street, Leeds 1. *Tel: Leeds 25579*

BRISTOL: Royal London Building, Baldwin Street, Bristol. *Tel: Bristol 28406*

Semco's 152a

ELECTRICAL REVIEW

19 June 1959 Vol. 164 No. 25 Established 1872

Industrial Interdependence

ALL the industries which provide a large measure of this country's material wealth are interdependent to some degree. Electricity is almost universally used, if not for the actual manufacturing process then for the ancillary factory services, while the electrical industry itself needs an adequate supply of such raw materials as steel, copper and coal, with factory space, production machinery and a transportation system.

An industry upon which our own also relies to a greater extent than is usually appreciated is the plastics industry, now one of the country's major trades and steadily increasing in importance. Plastics in various forms have been used in electrical components and equipment for a great many years, and they are now employed on a very extensive scale. Their adoption has generally coincided with the introduction of new types, for electrical engineers have not been slow to exploit the possibilities offered by these new materials. Some in fact have been produced primarily to meet the specific demands of the electrical world.

Today their use has become almost commonplace, ranging from small components in electronic apparatus—one of the most recent of which we have heard is moulded p.v.c. transistor holders—to such large components as liners for refrigerators, and from such applications as high voltage cable insulation to printed circuit techniques. Not only in the use of components are the industries linked, for electrical control and heating is widely used in plastic moulding machines and in post-forming laminated articles, and considerable increases have taken place in recent years in the power and capacity of high frequency plastic welding equipment.

The rapid advance being made in the plastics industry is evident from the exhibits shown at the International Plastics Exhibition now being held at Olympia. Many of the well-established thermoplastics and thermosetting materials have been improved, and more diversified grades are available. Materials recently introduced in the United Kingdom include polypropylene, high density polythene and cellulose proprionate. The display of polypropylene is of particular interest as the commercial production of this material in this country approaches. Rigid p.v.c. is assuming greater prominence in the vinyl class, particularly for extrusion, and glass reinforced components are finding an increasing use in many fields.

During the past two years large capacity moulding equipment capable of injecting up to 200 oz of material has been constructed, and pre-

plasticising equipment has become generally used on both large and small injection moulding machines. Initially pre-plasticising equipment was used on large machines to reduce cycle times, and its success has caused the principle to be adopted to an increasing extent on smaller machines. Extrusion machines are neater and more compact, although there has been a tendency towards increased outputs and a consequent increase in power consumption requirements, while greater attention has been given to the problem of servicing and the facility with which major components can be removed for service or replacement. A pre-heater giving improved cycle times is one of the more interesting developments of fully-automatic compression moulding presses, and during the past two years considerable progress has been made in the matched die moulding process.

CONTRACTORS' VIEWS

In his presidential address at this week's annual conference of the Electrical Contractors' Association Mr. C. C. Hyams testified to the good relationships which now exist between the contractors and other sections of the electrical industry. Such troubles as the contractors have stem from external influences. Mr. Hyams made particular reference to the Restrictive Trade Practices Act which is bedevilling all industries in its strange attempt to protect the "public interest" —an indefinable term which the Restrictive Practices Court is endeavouring to define.

Another bogey haunting the contractors is the growing tendency for building owners and architects to leave to builders the selection of firms to carry out the electrical installation work. In view of the special character of this work the older practice of placing the electrical installation work directly is much to be preferred. For one thing builders in general are not particularly interested in the adequacy of the electrical installation of a building; they tend to favour the lowest tender which will help them to cut their costs. In any event, as Mr. Hyams pointed out, the system imposes an unwarrantable burden on the electrical contracting industry.

NUCLEAR RESEARCH

That much of the work carried out at the Atomic Weapons Research Establishment at Aldermaston is not connected purely with the defence programme but involves an experimental determination of basic theories of nuclear reactions was evident during a recent visit to the Establishment. Although there is a strict security guard on most of the work at Aldermaston, we were allowed to see the new 12 MeV particle accelerator with which it is hoped that investigations can be made into nuclear reactions with heavy materials. Conventional machines can produce energies only up to 6 MeV, but energies of 10 MeV upwards are required in the studies of heavier materials.

It seems that the programme of work for this particle accelerator has already been planned for several months. It would thus appear that research into the theory of nuclear reactions is a long-term project too large to be carried out by the universities who, in any case, could not afford to equip themselves with the necessary accelerators. The knowledge obtained at Aldermaston regarding the basic theories is a useful contribution to science whether it is applied to weapons or civil reactors although Sir William Penney has stated that only 10 per cent of the research work carried out at Aldermaston is not directly connected with atomic weapons.

D.C. ELECTRIFICATION

The first phase of the £46 million Kent railway electrification scheme was inaugurated last week. This stage includes the coastal lines to Ramsgate and Dover, while the second phase, which is due for completion by 1962, will include the Ashford-Folkestone-Dover line. The third rail d.c. system which is in use all over the Southern Region has been retained for the new electrified lines, but the voltage has been increased from the standard of 660 V to 750 V, presumably to allow increased spacing of substations.

At the inaugural ceremony, Mr. G. R. Nugent, M.P., Joint Parliamentary Secretary of the Ministry of Transport and Civil Aviation, referred to the reduction of about 30 minutes in travel times between London and Ramsgate made by the electrification of these lines. Sir Philip Warter, member of the British Transport Commission and chairman of the Southern Area Board, also mentioned this and said that the longer and faster trains which will be run should increase the peak travel business by 30 per cent.

FREE TRADE DISCUSSIONS

It is now more than six months since the Common Market came into being and during this period, though there has been much talk and some recrimination, no progress has been made towards establishing a basis for a wider association between the Common Market and the other O.E.E.C. countries. In some quarters this is not felt to be very serious. It is considered that when the six countries have settled down and gained confidence in their new organisation they may be more willing to negotiate and to grant concessions. While there may be political arguments in favour of such a policy of "wait and see" it is not one that recommends itself to industry. In the interim manufacturers must struggle to hold and expand their markets against growing discrimination and they have to take decisions now that will be profoundly affected by the form of association with the Common Market which is finally agreed. Moreover, in an attempt to rationalise production and distribution, trading agreements are being concluded between firms in the member countries at a quite alarming rate. This will not only restrict the opportunities for British manufacturers but will increase the competitive ability of European firms in third markets.

Against this background the talks in Stockholm between Britain, Scandinavia, Switzerland, Austria and Portugal must be welcomed as a sign of renewed initiative. A freeing and extension of trade between these seven countries would by itself bring important mutual advantages. But the criterion by which any proposals emanating from the meetings must be judged is how far they will facilitate a closer association with the Common Market. This is the most important, and urgent, problem in European trade.

Electrical Contact Materials

SURVEY OF THEIR CHARACTERISTICS

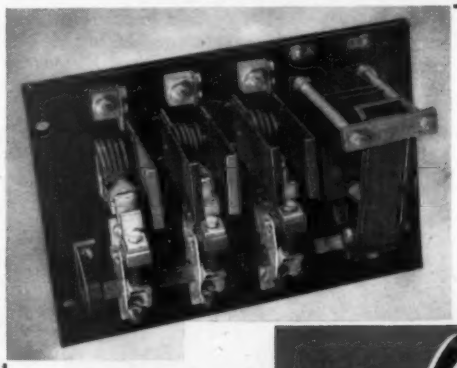
By N. A. TUCKER, A.M.I.E.E.*

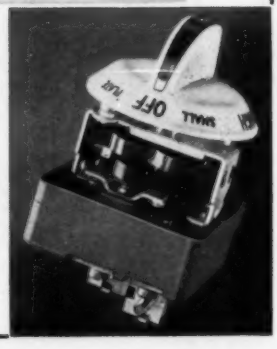
There is no one material that fulfils the ideal characteristics demanded of contact materials. In practice some form of compromise is effected, for the properties and conditions required to give low contact resistance and high current carrying capacity may be incompatible with those necessary for maximum interrupting capacity. The author discusses the properties and characteristics of "noble" metals and their alloys in contact applications

THE "noble" metals were probably first employed in electrical engineering by Faraday in his earliest researches into the phenomena of current electricity. The very rapid growth of the electrical industry since that time has seen their increasing use—especially in contact engineering.

Silver finds most applications because of its high electrical and thermal conductivities, resistance to oxidation and relative cheapness. In sensitive light duty gear, where there are small contact pressures, low voltages and little wiping action, silver contacts are seldom used because of the metal's tendency to form sulphide films, but silver and its alloys are the most important contact materials in medium and heavy duty spheres where the effect of tarnish films is overcome by higher voltages and heavier pressures.

The characteristics of the more noble metals—complete freedom from all forms of tarnishing, high melting points and great hardness—make them and their alloys ideal contact materials for light duty applications. Of these metals those most employed in contact engineering are platinum and rhodium. Platinum is very widely used in light duty gear, while rhodium is finding growing application in radio and audio frequency circuits.





Above: A 150 A contactor by Donovan Electrical Co., Ltd. The contacts are faced with fine silver

Right: Four-position cooker switch by "Diamond H" Switches, Ltd., employing silver contacts

Palladium and its alloys are being increasingly used in certain applications as substitutes for platinum mainly for reasons of economy, palladium being cheaper than all the noble metals except silver. Iridium and ruthenium alloyed with platinum or palladium form extremely hard contact materials and possess properties that are of value in very severe conditions, but osmium in alloy form has been employed only rarely in electrical contacts. Although gold has many of the ideal characteristics required of a contact material, it has found few applications due to inherent softness that leads to welding and contact sticking. However, gold alloys, whilst retaining the parent metal's corrosion-resistant properties, do not have this tendency to weld and stick.

Were it available, an ideal universal contact material would combine the following characteristics:—

(a) *Complete freedom from surface films.* Tarnish films on the surface of a contact may cause unstable contact resistance. If the electrical and mechanical duties are light, these films are particularly troublesome for they can prevent electrical contact. In heavier duty applications, where the voltage across the contacts is sufficiently high and where high mechanical pressure may be assisted by a wiping action as the contacts close, the film is less likely to cause open circuit conditions, but may lead to undue heating at the contact interface. The tendency of a contact material to tarnish is dependent on the conditions of use especially on the chemical constitution of the atmosphere, the humidity and the temperature.

(b) *Good electrical and thermal conductivities.* The current-carrying capacity of a pair of contacts of given size is largely dependent on the conductivity and the melting temperature of the material from which they are fabricated. Where conductivity is high the heat dissipated in the contacts through constriction resistance is kept to the minimum. For light duty contacts conductivity is of less consequence, but it is of first importance when a material is to be chosen for heavier duty contacts.

Thermal conductivity plays a significant part in governing the wear of a contact subjected to arcing. If the heat produced by arcing is not dissipated quickly enough the temperature of the contact faces will rise, electrical wear will be increased, and local melting may occur and cause welding. Where there is high frequency of operation, the influence of thermal conductivity may outweigh that of the intrinsic resistance of the material to destruction,

* Johnson, Matthey & Co., Ltd.

with the result that a relatively soft metal of high thermal conductivity may give better performance than a harder material of lower conductivity.

(c) *High resistance to electrical wear.* The degree of electrical wear depends on the resistance of the contact material to arc erosion and material transfer. For a given voltage, there exists for every material a value of current, known as the limiting current, below which a stable arc cannot be maintained, even with a small contact gap.

In d.c. circuits, although the contacts may be interrupting currents below the limiting values, some slight transfer of material from one contact to the other takes place, resulting, in the course of hundreds of thousands of operations, in the formation of a growth on the negative and a crater on the positive contacts. This transfer sets a limit to the useful life of the contacts. Above the limiting value, arcing will occur in both a.c. and d.c. circuits and the problem of electrical wear can become serious. Normally, materials possessing strongly marked cohesive properties (great hardness, high density, low coefficient of expansion, high melting and boiling points) will be characterised by great resistance to arc erosion.

There is no one material that fulfils the ideal characteristics demanded of contact materials. In practice, some form of compromise is effected, for the properties and conditions required to give low contact resistance and high-current-carrying capacity may be incompatible with those necessary for maximum interrupting capacity. Metals that exhibit low contact resistance usually have low hardness and poor resistance to mechanical wear. In order to fulfil the requirements of the different types of electrical equipment, a wide range of contact materials must be employed, for the relative importance of the contact properties varies considerably with the circuit conditions and type of duty imposed upon the contacts. It is not wise to generalise in the selection of contact materials, for each application must be considered on its merits. A balance must be struck between the chemical and physical characteristics of the material and the electrical and mechanical conditions imposed by the circuit.

Silver and its Alloys

Pure silver is the most widely used contact material. It has higher electrical and thermal conductivities than any other metal and is not subject to oxidation either at ordinary temperatures or under arcing conditions. In the annealed condition silver is soft, but it may be work-hardened to achieve a V.P.N. of 80 and over. Contact resistance between silver contacts remains extremely low, even with light mechanical pressures, and this fact, together with the metal's high thermal conductivity, makes for a minimum of temperature rise.

However, silver is attacked by sulphur compounds and becomes covered with silver sulphide films. In industrial atmospheres or in the vicinity of vulcanised rubber insulating materials silver contacts quickly become tarnished. Usually the sulphide film does not give rise to high values of contact resistance where there is sufficient pressure or wiping action to maintain the contacts in a clean condition, but silver should not be used for extremely sensitive and low-voltage contact applications for in these conditions the film may prevent electrical contact.

With currents of the order of 0·4 A and upwards at the usual mains voltages fine silver fulfils a considerable proportion of contact requirements. As conditions become more severe in terms of electrical loading or mechanical wear, silver alloys containing copper are used. In very severe conditions where silver or its alloys are found to fail by arc erosion, silver-tungsten, silver-molybdenum and silver-nickel materials are used, while if there is a likelihood of contact welding, silver-cadmium oxide is employed.

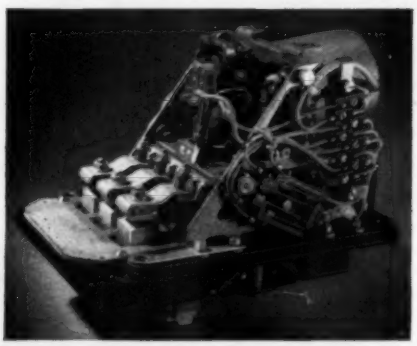
In light duty applications silver contacts are employed in telephone relays where circuit conditions are unlikely to cause rapid arc erosion or material transfer and in switches handling radio or audio frequency currents where a heavy wiping action maintains clean contact surfaces.

In medium duty applications resistance to electrical wear becomes of first importance and a compromise has to be made between the maintenance of low contact resistance and the ability to withstand the destructive effects of arcing. Increased weight must be given to the thermal conductivity of the contact material and of the contact support, particularly in relation to the frequency of operation.

Fine silver contacts fulfil a considerable proportion of the contact requirements in medium duty applications, particularly on the lower voltages and current ratings. In a.c. circuits with contact pressures of the order of 30 grams or more, fine silver is, without doubt, the most generally suitable contact material. It is also used extensively in d.c. circuits, but transfer troubles may arise if the current greatly exceeds 0·5 A.

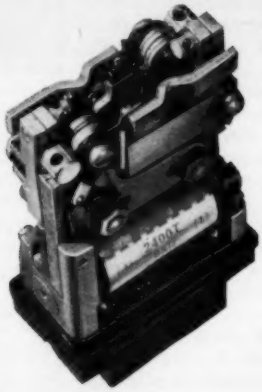
There is a very wide range of apparatus in the medium duty field in which fine silver may be used. Silver contacts are employed in small d.c. signalling devices under conditions of moderate current and voltage and where sufficient arcing occurs to break down slight surface films, but transfer troubles are unlikely to be an important feature, and in domestic switches where there are moderate currents, both a.c. and d.c., on domestic voltages. Other applications of silver contacts are in industrial heavy duty telephone type relays and in thermostats—where the currents are moderate on a.c. mains voltages, frequency of operation is fairly high, there is low speed to make, and high ambient temperatures.

The contactor group includes contacts employed in contactor starters and other types of industrial and traction control gear. Often the contacts in such gear consist of copper alone, which is used because of its high thermal conductivity and high specific heat. However, copper contacts are liable to severe overheating, due to the formation of a high resistance oxide film. This overheating leads to intense electrical wear and contact welding. Silver is much superior to copper, particularly where operation is infrequent and there are long idle periods. Usually, where silver is used, a smaller contact

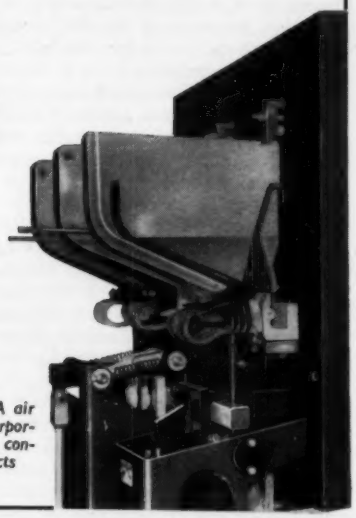


Three-phase aircraft changeover contactor by Rotax, Ltd. Contacts are of silver-nickel and the rating is 30 kVA at 208 V, 400 c/s

A "potted" relay assembly by Standard Telephones & Cables, Ltd. All contacts are of platinum except those of one relay which are of silver



Left: Carpenter high speed relay by the Telephone Manufacturing Co., Ltd., fitted with 40 per cent copper-palladium contacts



Right: B.T.H. 800 A air circuit-breaker incorporating silver faced contactor type contacts

size and lower contact pressure may be employed, which facilitate design, especially where space is limited.

The main advantage of fine silver in contactor applications is that contact overheating can be prevented almost entirely. In heavier duty spheres the contact surface is formed by silver inserts, silver-brazed on to copper contact facings, the size of insert depending upon the area over which contact is made. In lighter duty gear it is often more economical to employ contacts fabricated entirely from silver-copper bi-metal. While fine silver will maintain low contact resistance and prevent overheating on lower ratings, it is not always capable of withstanding severe electrical wear, and in these conditions standard silver (7·5 per cent Cu) or cadmium-copper-silver alloys are employed. These materials have increased hardness and erosion resistance but with increased contact resistance.

Silver contacts are employed in contactor starters where currents are moderate at voltages up to 550 a.c. and frequency of operation is high, and in industrial contactors where copper fails owing to high contact resistance caused by long idle periods in either the closed or open positions, or by overheating arising from high frequency of operation, or where ancillary arcing contacts are employed. Silver is also used as the contact material in motor vehicle starter switches, where there are heavy currents on battery voltages and the contacts are in operation only occasionally and for short periods.

Circuit-breaker contacts must combine the ability to carry normal current indefinitely without deterioration and to operate safely under abnormal or fault conditions, with the ability to handle initial peak current on closing, while still being capable of continuing normal duty. Two distinct requirements of the contact material are involved and it is normal practice to include separate current-carrying and arcing contacts to meet these conditions.

Fine silver finds application for main contactors in circuit-breakers where mechanical hammering, erosion and pitting are avoidable. In practice, the use of fine silver or of alloys high in silver content for current-carrying contacts of air breakers increases the normal current rating of the equipment. These materials permit design economy without exceeding the specified temperature rise, particularly where frequent contact cleaning is impossible.

While fine silver is firmly established as an excellent contact material for a wide range of applications, its comparative softness and liability to sulphide film formation have prompted the use of silver alloys which, while retaining the desirable properties of the parent metal, will give improved resistance to wear and usually to tarnishing.

The more common silver alloys are formed with gold, palladium, copper and cadmium. Gold-silver and palladium-silver alloys are only tarnish resistant if there is over 50 per cent of the added element present. Usually, these alloys have a reduced tendency to weld and are used in make and break, sliding and relay contacts.

Copper-silver alloys have increased hardness and wear resistance while the electrical and thermal conductivities retain high values. However, resistance to tarnish diminishes with increasing copper content. The alloys are employed where good resistance to wear is required under conditions of high contact pressure and a wiping action that removes tarnish and maintains low contact resistance. Cadmium-silver alloys are alternatives to the copper-silver alloys to which they are superior in their resistance to tarnishing.

The powder metallurgy combination of silver with cadmium oxide produces contact materials of which the most important characteristic is freedom from welding or sticking. In addition, the cadmium oxide has valuable arc-quenching properties that reduce electrical wear. The materials are ideal for circuits where sudden surges of current occur that would cause silver contacts to weld together—as, for example, in equipment subjected to short-circuit conditions where the current may rise momentarily to many times its normal value before the protective gear comes into operation.

Platinum

Pure platinum is too soft for general use as a contact material and usually commercial platinum is employed. In spite of the low conductivity of platinum (16·3 per cent I.A.C.S.) the metal is important as a contact material, because of its exceptional resistance to corrosion. Platinum is almost completely immune from oxidation or tarnishing at any temperature and in any environment.

Freedom from surface film formation means that platinum contacts will operate positively with light contact pressures or after long idle periods, and they are employed where complete reliability of operation and constant contact resistance are of prime importance.

Platinum is one of the most widely used contact materials in relays and signalling devices carrying small currents, in electrical impulse clocks, alarm or warning equipment and in contact-making instruments. In telephone relays operating at 50 V d.c. it is standard practice to employ fine silver contacts up to 300 mA and platinum contacts for currents above this value and up to 1 A. Even in the former case, where atmospheric conditions are bad, or where long continuous service is required, or where positive response under light pressure on closing is essential, platinum is employed.

Alloys of platinum have most of that metal's electrical characteristics together with greater hardness and resistance to wear or arcing. In most cases the alloying element is another metal of the platinum group, usually iridium or ruthenium. Increasing additions of iridium or ruthenium result in increased hardness and resistivity, however, and these additions also reduce the ductility of the alloys.

Iridium-platinum alloys are completely free from tarnish films, while their hardness makes them suitable for sensitive equipment in which the contacts have to withstand hammering under heavy spring pressures at high speeds of operation. The alloys are ductile up to 20 per cent iridium and contacts may be riveted. Above 20 per cent iridium ductility decreases rapidly and composite contacts must be used. Where there is absence of hydrocarbon vapour and in a.c. conditions iridium-platinum is employed for magneto contacts where it gives better electrical performance than tungsten.

Rhodium and Palladium

Rhodium is more resistant to chemical attack than platinum and, although it is superficially oxidised on heating to very high temperatures, is completely free from oxidation or tarnish. The metal is also very much harder and more resistant to wear than platinum and has a higher electrical conductivity, 35 per cent I.A.C.S.

The mechanical properties of rhodium preclude the fabrication of manufactured articles and the metal is employed almost exclusively as an electrodeposit which has a hardness of 800 V.P.N. Because the electrodeposits seldom exceed 0·0003in in thickness, rhodium, though expensive, can be used economically in a wide variety of electrical engineering applications.

The complete freedom of rhodium from tarnish films results in very low and stable values of contact resistance even under conditions of low contact pressures. But because the deposit is thin, rhodium-plated contact surfaces should not be used for making and breaking any circuit where there is likely to be arcing or sparking. Where these conditions are satisfied typical applications of rhodium-plated switch contacts are in range switches for communication equipment, plugs and sockets for use in corrosive atmospheres and in electrical and electronic instruments.

In plug and socket applications rhodium-plated contact surfaces have many advantages. Where rhodium is used against rhodium, contact potentials are completely eliminated which is of importance in sensitive equipment passing small currents. Arcing and sparking problems do not normally arise in light duty sliding contact applications and it is in this sphere that rhodium-plated contact surfaces are particularly successful. Even under light pressures sliding contacts of rhodium may be operated for long periods at a given spot and then moved to a new position without variation in contact resistance. This property is most useful and advantageous in such apparatus as variable inductors and potentiometers, instrument and radar slip-rings and in coaxial cables.

Right: An aircraft relay by Hendrey Relays, Ltd. Contacts are of platinum-gold-silver alloy or silver-cadmium oxide depending on the application

Left: This sensitive moving coil relay, made by Sangamo Weston, Ltd., is fitted with iridium-platinum alloy contacts. The contact rating is 0·5 W maximum at 250 V maximum

Though rhodium-plated surfaces sliding against each other have been used successfully in ideal conditions where there is very light contact pressure, in most sliding contact assemblies it is desirable to construct one of the contact members from a noble metal alloy, such as copper-silver-gold. Where it is imperative to have both surfaces rhodium plated, the contact member subjected to the heavier wear should be given a thicker deposit of rhodium and contact pressure should be kept to the minimum.

The electrical resistivity of palladium is the highest of the platinum group metals although the value is only slightly higher than that for platinum. The temperature coefficient of resistance is the lowest of the group—again only slightly below that for platinum. The conductivity is 16 per cent I.A.C.S. Palladium is sometimes used as a substitute for platinum, but is softer and begins to tarnish at temperatures of about 400 deg C. It will maintain a low and steady contact resistance, but is inferior to platinum in this respect. However, palladium is much cheaper than platinum and is often used on grounds of economy, where conditions permit, giving an appreciable reduction in cost per contact.

Palladium is the principal constituent in several contact alloys, the main consideration being an improvement in hardness and strength without affecting the corrosion-resistant characteristics of the parent metal. The most used alloys are 10 per cent ruthenium-palladium, 40 per cent silver-palladium and 40 per cent copper-palladium. Ten per cent ruthenium-palladium is generally similar to palladium, though somewhat harder and more resistant to wear. Forty per cent silver-palladium is completely resistant to tarnish at normal temperatures and is the hardest alloy in the silver-palladium series. The alloy has a palladium content that ensures freedom from

sulphide tarnish, and is one of the cheapest materials that will maintain a reasonably constant contact resistance in conditions that would cause the rapid failure of silver.

The 40 per cent copper-palladium alloy is similar in properties to the 40 per cent silver-palladium alloy, but it has greater resistance to material transfer in certain specialised conditions, a smooth surface being maintained when other alloys tend to develop sharp growths. It is used in telegraph relays and similar apparatus where frequency of operation is very high and contact clearances small. It is also used for making rubbing contact with nickel-chromium resistance windings in potentiometers where oxide build-up on the windings must be removed and where copper-palladium has long life and resistance to wear while maintaining minimum contact resistance.

Iridium, Ruthenium, Osmium and Gold

Iridium can be worked only with difficulty. However, wire and strip can be fabricated from it and the metal finds application where both hardness and corrosion resistance are important. Iridium has been employed in a few contact applications of a sensitive nature, but where a relatively heavy contact pressure is involved. Because it is difficult to work, contacts are limited to discs or turned parts brazed to base metal backings. Probably the main application of iridium for contacts is in alloys with platinum.

Ruthenium and osmium are almost unworkable, but when alloyed with platinum or palladium they give increased hardness and mechanical strength. Two alloys, iridium-ruthenium-platinum and iridium-osmium-platinum, which are exceptionally hard and wear-resistant, have been used in certain contact applications. These alloys are employed in severe conditions where low contact resistance must be combined with resistance to destruction.

Gold has complete resistance to tarnishing and atmospheric attack. The metal has a conductivity of 72 per cent I.A.C.S., only silver and copper having higher conductivities. Although these characteristics make gold a desirable material from which to fabricate electrical contacts, the softness and ready weldability of the metal causes contact surfaces to stick. As a result, gold is seldom used as an electrical contact material in an unalloyed form, although as an electrodeposit it proves useful for certain specialised applications—especially where the electrical and mechanical conditions are not severe and where low and stable contact resistance is required. It can be employed in light-duty plugs and sockets as well as for components sliding at low speeds against a rhodium-plated surface, as in certain v.h.f. tuning components. Fine gold electrodeposited by conventional processes is comparatively soft, but a new process has been developed that produces a deposit having a hardness of about 115 V.P.N. This increase in hardness is attained by depositing an alloy of gold with approximately 2 per cent of another noble metal.

Three gold alloys originally developed as substitutes for the more expensive platinum are employed as contact materials. Although they do not tarnish, these alloys are inferior to platinum in resistance to electrical wear. They are 30 per cent silver-gold, platinum-silver-gold and copper-silver-gold. This last alloy, containing 62·5 per cent gold, is of importance for it combines complete resistance to tarnishing at ordinary temperatures with spring qualities comparable with those of phosphor bronze. It is ideal, especially in the form of wire or strip, for light duty sliding contacts operating against rhodium, 40 per cent silver-palladium and silver.

NEW BOOKS

Patents for Engineers. By L. H. A. Carr and J. C. Wood. Pp. 105. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 18s.

Whilst there is no lack of books dealing generally with patents and patent law there have been few, if any, written with the engineer specifically in mind. The present book is the joint work of a chartered electrical engineer and a barrister-at-law and is based on a course of lectures given at the Manchester College of Science and Technology. It gives a short, concise and clearly written account of patent law and procedure and is illustrated by examples and court cases taken largely from the engineering, and particularly the electrical engineering, field. No attempt is made to short-circuit the patent agent whose employment is recommended in all cases. But the agent's work can be enormously facilitated when he has to deal with a well-informed client, and this book does everything possible to guide the hopeful inventor in his long and hazardous journey from the birth of an idea to its commercial exploitation.

Sections are included on what is and is not patentable, on the position of employee inventors, on the preparation of specifications, on commercial aspects and on the private inventor. The kindred subjects of registered designs, copyright and trade marks are briefly touched on and it is interesting to note that colour is a recognised element in design and that in 1947 Morphy-Richards succeeded in an action brought against a competitor who copied their primrose-coloured electric iron.

The authors show clearly that it is what the invented thing *is* and not what it *does* that forms the basis on which the patent is granted. For example, as late as 1902 Turnbull was able to patent the traction battery booster because although the use of shunt and series coils for compounding was known at the time the combination by Turnbull was new and therefore patentable.

A final chapter gives a fascinating and all-too-brief account of some of the landmarks of technical history as illustrated by patent specifications. These include the earliest electric motor patent (Davenport, U.S.A., 1837); Parsons' turbine (1884); the transformer (Deri and others, Budapest, 1885); the compound-wound generator (patented by Crompton and Kapp in 1882 but previously described by John Hopkinson and by Charles Brush, U.S.A.); the commutating pole (Crompton and Swinburne, 1886); the loose-handle quick-break switch (Holmes, 1884); the vacuum discharge (Edison, 1884); and the induction motor (Tesla, 1888).—D.J.B.

BOOKS RECEIVED

Electronic Circuit Theory. Pp. 564; figs. By H. J. Zimmermann and S. J. Mason. John Wiley & Sons, Inc. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 86s.

Solid State Magnetic and Dielectric Devices. Pp. 542; figs. Edited by H. W. Katz. John Wiley & Sons, Inc. Chapman & Hall, Ltd. Price 108s.

Wiring Circuits. 2nd Edition. Pp. 231; figs. By E. Molloy. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 12s 6d.

ELECTRICAL CONTRACTORS' CONFERENCE

ACTIVITIES AT EASTBOURNE

ON Sunday last and the two succeeding days members of the Electrical Contractors' Association and its allied organisations, the National Federated Electrical Association and N.E.C.T.A., Ltd., were at Eastbourne for their annual conference. During Sunday afternoon the delegates registered at the Grand Hotel and in the evening there was a "Get Together" for conversation and music.

At the Winter Garden on Monday morning the Associations were given a civic welcome and the President, Mr. C. C. Hyams, M.M., delivered his address, a summary of which follows these notes. After this the members went into their annual general meeting.

In the afternoon a garden party, on traditional lines, was arranged at Glynde Place, a very pleasant setting. Music was provided by the band of the Royal Corps of Signals. The evening function was a reception (with dancing) in the Winter Garden at the invitation of the Mayor of Eastbourne.

Tuesday morning's session was devoted to the reading and discussion of a paper by Mr. R. A. Joseph, B.Sc., M.I.E.E., "Specialised Industrial Applications and Installations." A debate was staged in the afternoon when Mr. J. Mortimer Hawkins proposed a motion "That Society is better served by independent business undertakings than by large amalgamations." Mr. V. J. Stock opposed the motion. The final business was the installation of Mr. Stock as the new President and a brief address by Mr. Stock.

Mr. and Mrs. Hyams held a reception at the Winter Garden on Tuesday evening when again there was dancing.

Left: The President, Mr. C. C. Hyams

Right: Mr. V. J. Stock, the new President

PRESIDENTIAL ADDRESS

Mr. Hyams' Review of the Past Year

IN the opening paragraph of his address, delivered on Monday morning, Mr. Hyams said that his purpose was to touch upon points of importance to the electrical industry as a whole, rather than to the Association alone. In an industry such as this, development within a year could be quite breath-taking, but changes should not cause them to deviate from the principles which they had learned to be the proper ones.

The Association had about three thousand members who were responsible for about 85 per cent of the installation work carried out by contractors, apart from the great deal of work done by them overseas. He regretted the loss by death and retirement of the pioneers in their particular field and said he would like to be able to welcome into the industry young men of the calibre of those who had done so much to advance the industry and had made the Association what it was.

The electrical industry had the advantage of a Fair Trading Council whose purpose was to lay down a code of fair trading ethics. The Council aimed at the regulation of business between all sections of the industry so that each section received its fair reward while the public was well served and the cause of electricity advanced. This led the President to turn to the operation of the Restrictive Trade Practices Act and to consider how far the activities of the Commission threw any light on the manner in which the public interest was allegedly being protected. The seven "escape" clauses, which set out the conditions to be satisfied if a trade agreement was not to be deemed contrary to the public interest, were attached to the address. Mr. Hyams examined some cases which had been dealt with by the Restrictive Practices Court to show how even fair and reasonable agreements had failed to pass this test. The result of the Act was that fair trading practices which had been proved to be of immense benefit to the public were being voluntarily abandoned and commercial chaos was taking their place. There was no differentiation

between industries and no regard was paid to the technical considerations involved in the trading structure of the electrical industry. The industry should make representations to the Government upon the need for amendment of the Act, to avert danger to the country's economic stability. He was happy to record the friendly relations between the Association and the various manufacturing groups which he hoped would continue.

The President next touched upon the subject of the variety of conditions of contract to which the electrical contracting industry, more than others, was subjected. He referred particularly to such items as the percentage of the total value of the contract which was to be retained and the period of retention—items of great importance which varied widely. He believed that the time had come when an authoritative and impartial body should establish a standard form of contract governing the relationship between the electrical contractor and his customer; provision could be made for special circumstances.

Almost since the industry came into being it had been the practice in building work generally for the engineering specialist trades to be invited by the architect, consulting engineer or building owner to quote directly. It had been increasingly the practice for the electrical contractor to be nominated by the building owner or by his professional adviser, and for the builder or main contractor to be charged with the responsibility of securing tenders for the work of the specialist trades. Now there was a tendency for the building contractor to be given the responsibility of securing tenders from the specialist trades. As a consequence electrical contractors were called upon to prepare tenders for some eight or ten builders who were quoting for a contract, imposing upon the industry a burden which it should not be called upon to carry and unnecessarily increasing the price which the industry had to charge for its services. An endeavour to rectify this situation was being made by a committee of co-operation between the Association of Heating, Ventilating and Domestic Engineering Employers and the E.C.A.

Policy on Wages

Upon the subject of wages, the President said that the time had arrived when consideration should be given to the need for a national approach to the standard of wages which should be paid throughout the industrial community. Claims were based upon the prosperity of an individual industry and yet experience showed that a wage increase in any given industry had immediate repercussions on every other. We should consider the national prosperity, as distinct from individual prosperity, and regulate wages and judge our conditions in the light of the national interest.

The electrical industry was one in which, perhaps more than in others, technical development was extremely rapid. But it was being recognised that effective utilisation was possible only if the electrical installation was adequate. In this connection Mr. Hyams recalled the recent I.E.E. symposium on the provision of adequate electrical installations in buildings of which Mr. R. A. Marryat, a past-president of the E.C.A., was chairman.

The President claimed that the electrical contractor could match with his installation practice the advanced techniques of other sections of the industry. Now members of the Association were installing electronic equipment (hitherto considered to be a specialised task) with ease and confidence.

Referring to the good relationships which he had found to exist during his year of office, Mr. Hyams made special mention of Sir Henry Self, chairman of the Electricity Council. Their relationship with that Council and with the Area Boards, through the Area Co-operation Committees, was excellent. The President concluded with an appreciation of the assistance which he had received from the chairmen and secretaries of the Association's sections and branches, the vice-presidents, Mr. J. G. Briggs (chairman of the Executive Committee), the Association's committees, and Mr. L. C. Penwill (director and secretary) and his staff.

SPECIALISED INDUSTRIAL INSTALLATIONS

Abstract of Paper by Mr. R. A. Joseph, B.Sc., M.I.E.E.

THE full title of this paper which was read and discussed on Tuesday morning was "The Specialised Industrial Application and Installation; the Electrical Contractor's Opportunity in the Maintenance Field." In his introduction the author drew attention to the increasing specialisation in industry which induced a corresponding specialisation among electrical contractors. Breakdowns in industry were expensive and accordingly maintenance assumed great importance. Contractors undertaking this work must not only have the men and equipment but also the increased knowledge demanded by the complexity of modern plant.

An electrical installation contractor desiring to work in the industrial sphere must be a qualified and trained engineer. Not only must he install equipment, he must act as an adviser and, in fact, design the majority of installations for which he was responsible. He would be able to introduce the production engineer to the manufacturers of the equipment needed. It followed that the contractor must know something of the processes of a particular factory so that he could assist with production problems and ensure the installation of the correct equipment and the correct distribution system. He would also be expected to conduct negotiations with the electricity supply authority.

Mr. R. A. Joseph

In considering the design and execution of industrial installations Mr. Joseph dealt first with wiring systems, indicating the conditions which governed choice. He pointed out the advantages of the busbar trunking system where movement of machinery was frequent. There had been considerable advances in fixing methods including stud welding, plug-firing guns, girder clips and cable trays. The use of adhesives had made great advances. All circuit-breakers, switches and fuses had to be able to deal with calculated fault currents. In this connection Mr. Joseph referred to the so-called miniature circuit-breakers which had many advantages.

The author then examined causes of breakdown, knowledge of which assisted the contractor to design efficient installations and plan a satisfactory maintenance service. Dealing first with rotating plant, he compared the merits of ball and roller bearings and sleeve bearings. He noted the comparative neglect of sliprings and commutators which needed regular attention. Dirt, a term including metal particles, grease and lubricants, would not cause serious harm if there were suitable maintenance.

It was not so easy to guard against damage by damp in some situations, but it might be possible to exclude the cause or use a suitably-designed machine. Rodents were another frequent cause of damage.

Overloading was a main cause of breakdown, often due to high setting of overload trips. Low voltage at the motor terminals also occurred regularly; it might be caused by the use of inadequate cable. Many troubles arose from the use of the incorrect type of motor enclosure for particular applications and from the wrong choice of motor characteristics. Mr. Joseph stressed the need for suitable controllers and correct alignment. Although special devices were incorporated in some starters, breakdowns through single-phasing of polyphase motors were common. Regarding control gear, the things to guard against were wear, dirt and damp, misuse and incorrect applications.

Before setting up a preventive maintenance scheme a complete survey of the electrical plant should be made, particular note being made of possible points of trouble. A regular check should be taken of the insulation resistance of all windings and air gaps of rotating machinery as well as all bearings and parts, and connections. Points to be watched in control gear were also specified in the paper. Mr. Joseph stated that inspection should be regular but not too frequent where dismantling was involved. A record of the results of inspections should be maintained and the results should be studied intelligently to enable preventive steps to be taken and reports prepared for the contractor's client. Follow-up maintenance was either left to the contractor's discretion or was the subject of definite instructions. It was often wise to replace whole sets of components when it was necessary to dismantle them because of the failure of one part.

Should a breakdown occur the contractor must be ready to act immediately, day or night, and sufficient spares must be available to meet expected contingencies. It was emphasised that it was not sufficient merely to repair a fault; action must be taken to avoid repetition.

Repairs on Site

Methods of handling repairs on site were suggested. In this connection it was advisable to have clear circuit diagrams available and to sectionalise circuits. In the case of small and medium-sized motors it was useful to have a spare for use while a faulty motor was in the workshop for overhaul. The contractor could either have a workshop of his own or he could have working arrangements with a specialist repair firm. Mr. Joseph indicated what sort of equipment was needed for the repair service and how the service should be organised and operated. He dealt in some detail with the kind of work which had to be carried out by the electrical fitting, winding and mechanical departments. Much attention was given to the insulation of motor windings and the paper included a table showing the main characteristics of the seven classes of insulation used for the purpose.

Stress was laid on the importance of the operative's skill. In this connection Mr. Joseph drew attention to the encouragement given to apprentices by the E.C.A. and the National Federated Electrical Association to attend technical classes and to follow a carefully prepared apprenticeship scheme.

Accurate records must be kept of all assembly details so that there could be no errors in reassemby. Final testing and the reinstallation of plant in the works formed the final items of the " practical " part of the paper.

Mr. Joseph concluded by remarking on the goodwill engendered by a complete and efficient maintenance service. Such service would ensure for the industrial installation contractor work which was full of interest in an ever-expanding field.

I.E.E. Summer Meeting

THE Summer Meeting of the Institution of Electrical Engineers has been taking place this week in the North Midland Centre. The proceedings opened at the Royal Hall, Harrogate, on Monday evening when members and their ladies were received by the Mayor and Mayoress of Harrogate, Councillor G. H. Holroyd, J.P., and Mrs. Holroyd. The reception was followed by dancing and musical entertainment.

On Tuesday morning members were formed into parties for visits to 14 different works and installations. Some of these parties visited Harewood House in the morning and a works in the afternoon, while others had their factory visit in the morning. The party which visited the Guiseley lamp works of Crompton Parkinson, Ltd., saw the production of all types of Crompton lamps. The range includes tungsten filament lamps up to 1,500 W (including special purpose lamps such as rough service, infra-red, reflector and colour glaze), fluorescent tubes and mercury vapour discharge lamps. At the Bradford works of the English Electric Co., Ltd., another party saw something of the manufacture of a comprehensive range of electric motors and generators for industrial and traction applications from fractional sizes to 2,000 h.p. together with main generating systems, control gear, actuators and motors for aircraft. The Dewsbury works of the Yorkshire Electric Transformer Co., Ltd., were also visited. Here power transformers are made from medium size distribution to large generation and transmission units of 75 MVA rating at voltages up to 150 kV.

In the evening there was a reception at Leeds University where members were welcomed by the Pro-Chancellor, Brigadier J. Noel-Tetley, and the Vice-Chancellor, Sir Charles Morris.

Wednesday was devoted to another round of visits which included Haddon Hall and Chatsworth House. The industrial establishments visited included the Attercliffe Common works of the Metropolitan-Vickers Electrical Co., Ltd., at Sheffield. The main products of this works are traction motors and other rotating machines for electric, diesel-electric and gas turbine locomotives, multiple unit trains, tramcars, trolley-buses and other forms of road and rail traction.

Yesterday (Thursday) some of the members went to the Wakefield " B " power station of the Central Electricity Generating Board. This 240 MW plant was described in detail in the *Electrical Review* of 12th October, 1956. At Huddersfield the f.h.p. motor factory of Brook Motors, Ltd., was visited while another party were inspecting the Holme Moss television transmission station of the B.B.C. Other parties went to the works of J. Blakeborough & Sons, Ltd., E. Green & Son, Ltd., and Hopkinsons, Ltd. In the evening there was a dinner-dance at the Hotel Majestic, Harrogate, which was presided over by Mr. S. E. Goodall, President of the I.E.E., supported by the chairman of the North Midland Centre, Mr. J. D. Nicholson.

Today there will again be a number of alternative all-day combined visits and excursions. At the Harworth works of Glass Bulbs, Ltd., a subsidiary of the G.E.C. and B.T.H. companies, members will see the production of general lighting service lamp bulbs from ribbon machines, the output from which is now sufficient for the entire home market and substantial exports.

The meeting will conclude this evening with a supper dance and cabaret at the Hotel Majestic at which members and their ladies will be the guests of the Yorkshire Switchgear & Engineering Co., Ltd., and the Yorkshire Electric Transformer Co., Ltd.

PLASTICS EXHIBITION and CONVENTION

NEW MATERIALS AND MACHINERY ON SHOW

NEARLY 300 manufacturers and suppliers of materials, equipment and products from thirteen countries represent every aspect of plastics technology at the International Plastics Exhibition now being held at Olympia, London (17th to 27th June). The exhibition, which occupies over 270,000 sq ft of space in the Grand, National and Empire Halls, illustrates the tremendous expansion of plastics technology and the steadily increasing part being played by plastics in nearly every industry and in the home. Many new and improved materials are being shown, including high density polyethylene, cellulose proprionate and polypropylene, a tough, heat-resistant plastic. Some 600 items of machinery and equipment, much of it operating, are being shown and approximately 12,000 different finished products ranging from clothing and floor covering to electrical components, ships' propellers, boats, car bodies and building materials.

A special feature of the exhibition is a design display sponsored by *British Plastics*, the exhibition organisers, and arranged in conjunction with the design committee of the Plastics Institute. Products for the United Kingdom section competing for the 100 guineas prize have been selected from the design index of the Council of Industrial Design. A twelve-screen film display in which 24 new colour films describe the rapid progress of plastics in all its applications is running continuously throughout the ten days of the exhibition. Fifteen of the films are devoted to industrial applications; for example, it is shown how the flame-resistant qualities of plastics make them suitable for use in coal mines for conveyor belting, ventilation ducting, protective clothing, electrical insulation and pit prop caps.

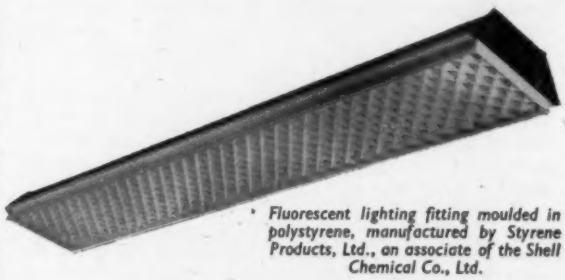
The year's International Plastics Convention is being held in conjunction with the exhibition, 16 papers being presented on the theme of "Developing Fields." The papers fall under general headings of polyolefins, material developments, design trends, recent developments in glass reinforced plastics, and expanded plastics and extrusion. The various sessions, at which papers by speakers from Holland, Denmark, Italy, Germany and the United States, will be presented, will be held on 22nd, 23rd and 24th June.

Materials

A wide range of products is shown in raw material form by I.C.I., Ltd., including polypropylene, polytetrafluoroethylene, polythene and polyvinyl chloride. Three products which have been introduced since the 1957 exhibition will be featured by I.C.I. (Hyde), Ltd., namely, "Novon 10," a thin, hard, semi-rigid p.v.c. foil designed for lamination to steel and non-ferrous metals; "Novon" unsupported p.v.c. sheet; and "Vynalast," a p.v.c. foil with a paper backing. Another subsidiary company, Marston Excelsior, Ltd., are showing examples of glass cloth/epoxy resin fabrication for the 7 GeV proton-synchrotron project at Harwell, and industrial fans with laminated plastic blades.

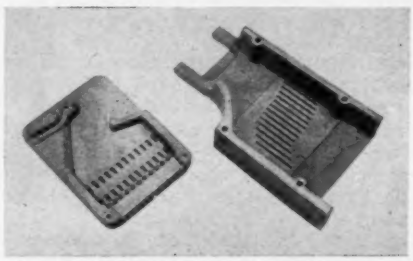
Among the range of plastic materials shown by the Shell Chemical Co., Ltd., is "Carlona" polypropylene, which was introduced in trial quantities by the company last November. Development applications showing its properties are exhibited. A thermoplastic also featured on this stand is high density polyethylene, a Ziegler type polymer offering increased heat resistance, tensile strength and rigidity, chemical resistance to solvents and lower permeabilities to gases and vapours than polyethylene produced by high pressure methods. Expanded polystyrene having densities down to 1 lb/cu ft is also being shown.

A porous plastic material, "Vyon," produced from high density polyethylene is being shown by Pritchett &



Fluorescent lighting fitting moulded in polystyrene, manufactured by Styrene Products, Ltd., an associate of the Shell Chemical Co., Ltd.

An 11 kV three-phase busbar unit with dividing box attachment cast in "Araldite" epoxy resin



Arc chute components moulded in "Rosite"

Gold & E.P.S. Co., Ltd. It has already found applications in air and liquid filtration and for electrolytic diaphragms where its flexibility makes it easy to bolt or slide it into tanks. A microporous plastic, "Porvic," developed primarily to replace conventional wood separators in electric storage batteries, is also shown on this stand. It is made from p.v.c. of high molecular weight without the addition of a plasticiser and can be supplied in sheets of 0·03in thickness up to 36in by 12in.

A wide range of synthetic resin products including "Araldite" epoxy resins, "Aerolite" urea-formaldehyde resins, "Aerodux" resorcinol-formaldehyde resins and "Redux" adhesives are shown by Ciba (ARL), Ltd. Examples of applications of "Araldite" resins in the electrical industry include high voltage insulators, bushings and impregnated and potted transformers.

Electrical components moulded in mineral-filled melamine, paper-filled melamine, wood-filled urea and paper-filled urea are being shown by B.I.P. Chemicals, Ltd., with other mouldings for the electrical industry in D.M.C. polyester dough moulding compound. Among the products on the Rubber Improvement, Ltd., stand are translucent and opaque "Rilite" glass fibre sheets in both flat and corrugated profiles, and "Leonex" and "Rilflex" p.v.c. multi-ply fire-resistant anti-static conveyor belting. Rosite, Ltd., are showing a cold moulded insulating material having high arc resistance characteristics, dimensional stability and moulding accuracy. Mouldings of up to 120 sq in projected area can now be produced in this material. The display features a new arc chute for contactors, resistor formers and terminal blocks for electric cookers, cold moulded in this material. For electrical applications where good dielectric strength is required, parts moulded in this material can be impregnated with special waxes.

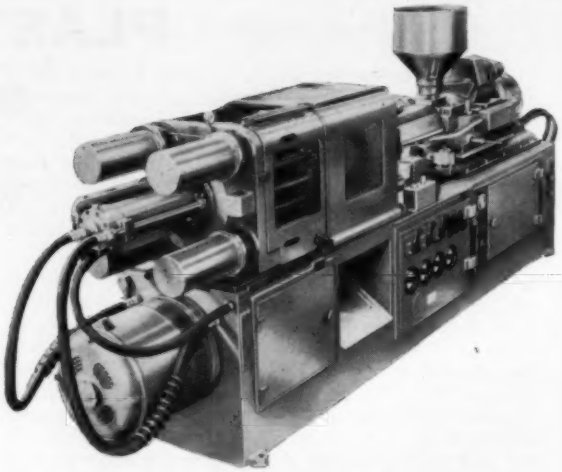
M. & B. Plastics, Ltd., are showing their complete range of thermoplastics, including "Acelon" cast film made from cellulose acetate, particularly suitable for the core insulation and identification wrapping of telephone relays, etc., and "Meculon" metallised film suitable for the production of wound dielectric capacitors. It has an unplasticised polyethylene terephthalate film having a thin layer of aluminium deposited under high vacuum on to one surface, giving a mirror-like finish.

A new system of colouring p.v.c. extrusions has been introduced by Bakelite, Ltd., and this is shown with a number of materials used in electrical and electronic components and equipment, including copperclad laminates used in printed circuits, arc welding transformer cases made from reinforced polyester resin and telephone instrument mouldings, light fittings, plugs and sockets and electric meter cases in phenolic and alkyd materials.

Albright & Wilson (Mfg.), Ltd., are showing plasticisers, stabilisers, accelerators, resin intermediates, corrosion inhibitors, mould release agents, fungicides and antifoaming agents and the "Hetron" range of polyester resins which are widely used in the United States for electrical applications.

A range of chemically treated glass fabrics and tapes for glass reinforced plastics shown by Marglass, Ltd., includes glass cloths prepared for electrical applications which have been lent by electrical insulation manufacturers, and a selection of standard and special lines of extruded and fabricated plastic sections including joint mouldings, packaging tubing and insulation sleeving is exhibited by C. & C. Marshall, Ltd.

British Resin Products, Ltd., a company in the Distillers Plastics Group, are exhibiting "Rigidex" high density polyethylene, a highly crystalline material which



The Windsor AP.16 injection moulding machine

can be processed by all the accepted methods for handling thermoplastics, and a special display is devoted to the new "Rockite" polyester dough moulding compound which has high arc resistance, making it suitable for switchgear manufacture and such applications as junction boxes, heater ducting and motor housings. The twelve-screen continuous colour film display is featured on this group's stand.

Synthetic resins which can be worked into laminates or varnish for electrical applications are being shown by Chas. Lowe & Co. (Manchester), Ltd., with "Sebalkyd" resins which can be used for foam potting electrical components, and BX Plastics, Ltd., a subsidiary of the British Xylonite Co., Ltd., are exhibiting their range of thermoplastics, including a section devoted to electrical and electronic applications. Materials displayed by Lintafoam (Sales), Ltd., include polyurethane foam, flexible polyurethane moulded pipe lagging and rigid polyurethane foam for insulating purposes, and Utilex, Ltd., are displaying a full range of cellulose acetate film in clear transparent, coloured transparent, and coloured opaque finishes.

Nylon and Terylene raw materials are shown by the Dutch firm of Verenigd Plastic-Verkoopkantoor N.V., with finished mouldings including telephone housings and electronic components. "Duraglass" glass fibre products, "Duramatt" chemically and mechanically bound chopped glass strand mats and "Durestos" resinated asbestos moulding materials are shown on the stand of Turner Bros. Asbestos Co., Ltd., and a large variety of compression, transfer and injection mouldings is being shown by Birkbys, Ltd.

The plastics products manufactured by Formica, Ltd., range from laminates to extrusions, including industrial laminates in which the dielectric properties and moisture resistance of synthetic resins are combined with the mechanical characteristics of the fibrous material employed. Portland Plastics, Ltd., are showing a range of tubing in polyethylene, p.v.c. and nylon in bore sizes from $\frac{1}{10}$ to 2in, and nylon or p.v.c. film, while a number of moulding powders are shown by Kodak, Ltd., including cellulose acetate butyrate for non-yellowing, decorative and protective coatings for aluminium and other metals and for paper and p.v.c. A wide range of catalysts, accelerators and stabilisers is being shown by Novadel, Ltd., and a thermoplastic sheet made from a plastic

copolymer and synthetic rubber is displayed by the North British Rubber Co., Ltd.

A lightweight, high impact thermoplastic resin, "Cyclolac," is exhibited by the Anchor Chemical Co., Ltd., and the BTR Industries, Ltd., group are showing a number of recent developments, including rigid p.v.c. pipes and fittings, foamed rigid p.v.c., and polytetrafluoroethylene, while the "Vinamul" and "Vinalak" range of polymers and copolymers in emulsion and solution form are shown by Vinyl Products, Ltd. High impact polystyrene sheet is the main feature in a display shown by Saro Laminated Wood Products, Ltd., which includes refrigerator cabinet liners and radio and television parts. Other materials seen on this stand include expanded polystyrene foam. A number of companies are exhibiting colouring pigments, including Reeves & Sons, Ltd., Llewellyn Ryland, Ltd., and the Geigy Co., Ltd.

Among the range of barrier creams and skin cleansers shown on the stand of Scientific Pharmacals, Ltd., is "Kerocleanse 22" for removing deposits of synthetic resin compounds.

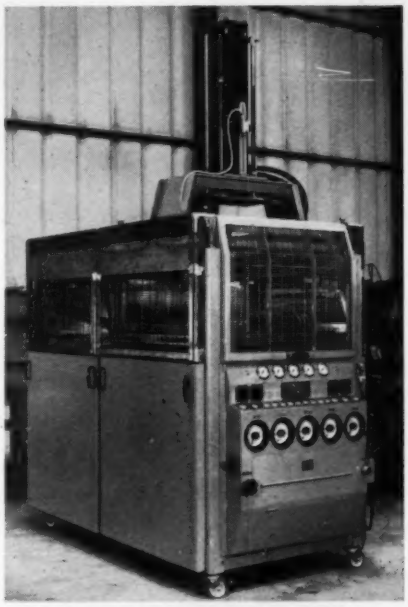
Machinery

There is a large selection of machinery, much of it incorporating automatic control, for the production of plastic materials, moulding and extrusion, and for the machining and treatment of finished products.

One of the latest additions to the range of injection moulding and extrusion equipment manufactured by R. H. Windsor, Ltd., shown for the first time, is the AP.200 injection moulding machine capable of moulding articles up to 124 oz in polystyrene and fitted with a twin screw two-stage pre-plasticising unit. Another newly designed machine is the AP.16 fully automatic injection moulding machine equipped with a single screw pre-plasticiser. F. J. Edwards, Ltd., are displaying their model 2620 automatic vacuum forming machine suitable for the rapid forming of cellulose acetate foil and other materials up to heavy gauge p.v.c. and polystyrene sheets. A heater divided into three concentric zones, each independently governed by variable control, is incorporated, and the machine, which is equipped with a 1½ h.p. motor, is suitable for 400/450 V three-phase 50 c/s supplies, the total power consumption being 7·5 kW.

The machines exhibited by Alfred Herbert, Ltd., include the 275.T injection moulding machine which has a locking pressure of 275 tons and incorporates a retractable heater carriage and low voltage induction heating. The electrical equipment is housed in a separate floor-mounted cabinet which also contains the three pyrometers for the necessary temperature control. Two vacuum forming machines (for straight forming and drape) are also being exhibited on this stand by T. H. & J. Daniels, Ltd. Ceramic embedded type heaters mounted on reflectors are incorporated and on the larger machine double heaters can be fitted, one above and one below the thermoplastic sheet.

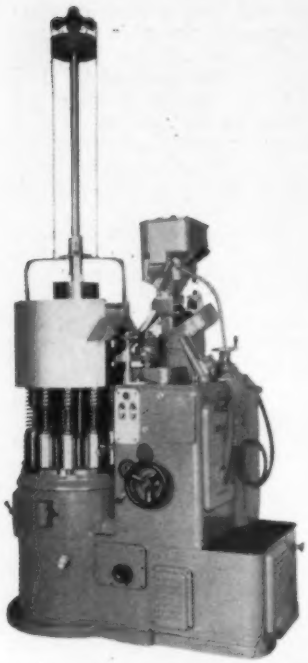
The latest "Series 2" high speed injection moulding press shown by Dowding & Doll, Ltd., operates at high cycling speeds, up to 1,200 per hour, achieved by a short adjustable plunger stroke, a mould opening and closing action which takes less than two seconds and the high plasticising rate of the heating chamber. Two process timers and three heater controls are mounted on a



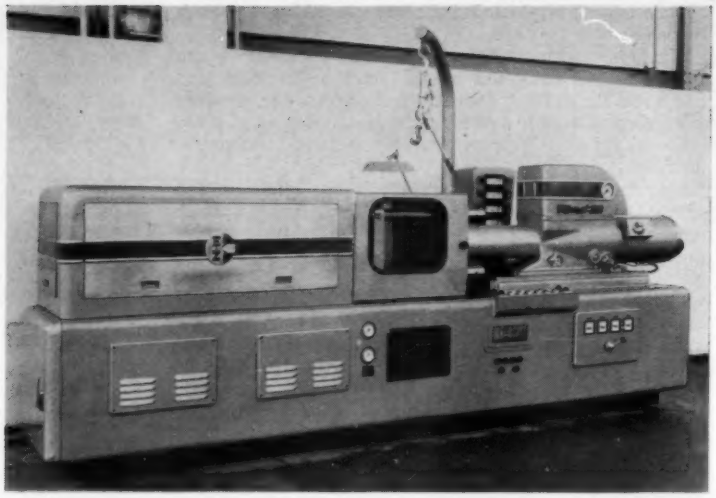
Daniels/Latymer 30/30 vacuum forming machine

Below: Dowding high speed injection moulding machine

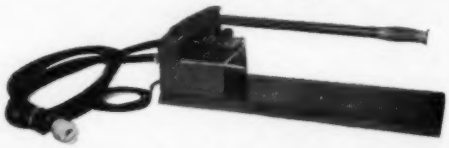
Edwards vacuum forming machine



The Tavannes moulding press



Eckert & Ziegler injection moulding machine with screw unit



Morane laminating press

separate panel with operating push-buttons and two dial thermometers.

Two machines of Swiss manufacture are being shown by John Kimbell & Co., Ltd.: the Tavannes automatic moulding press for the production of small or intricate mouldings with or without thin threads from all common thermoplastic materials, and the Bucher-Guyer press for the production of articles of intricate shape. Three new types of injection moulding machines appear on the stand of Ed. Brand, Ltd., London, the United Kingdom representatives of Eckert & Ziegler G.m.b.H., two screw type machines having infinitely variable injection pressure and injection speed, and a machine with conventional plunger unit.

A range of injection moulding presses and sample mouldings produced on the machines is being shown by O. Florin, Ltd., and details of the two models now in production at Portsmouth resulting from an agreement with the Italian injection moulding manufacturers, Negri Bossi & Cie, of Milan, will be available at the stand of J. Evans & Son (Portsmouth), Ltd. Two- and three-unit injection moulding machines are shown on the stand of Foster Yates & Thom, Ltd., with a Foster Wucher W.700 automatic low pressure moulding machine, fitted with a ten-station rotating table, shown operating. The cylinder of this machine is heated by three 1 kW and one 500 W band heaters, three thermocouples being provided for temperature indication in the three zones, which can be independently controlled.

Two models of the "Arburg" injection moulding machine which can be used for potting electrical components or moulding switch plugs and other small articles are shown operating on the Engis, Ltd., stand, with lapping compounds for finishing mouldings, extrusion dies, etc., a rotary abrasive tool for de-flashing plastics and a self-adhesive grinding disc for pre-finishing general mould contours.

A 25-ton model 800 automatic compression moulding press with a complete cycle time, excluding curing, of five seconds is seen in operation on the stand of Alchem Processes, Ltd., the United Kingdom representatives of F. J. Stokes Corporation of Philadelphia, and a ½ oz capacity injection moulding machine which incorporates a 1 kW cylinder heater, and a 150 W ceramic filled nozzle heater is being shown by Hupfield Bros., Ltd., at this exhibition for the first time.

Six plastic injection moulding machines are exhibited by Peco Machinery Sales (Westminster), Ltd., having shot capacities ranging from 1 to 90 oz and locking forces from 25 to 750 tons. A new design of heating chamber is also being shown in which heating is applied to the plastic material by four electric elements mounted within a spreader.

A number of injection moulding, dicing, cutting, screening and other machines of both British and overseas manufacture can be seen on the stand of Industrial Plastics, Ltd., including Bandera, Hartig, Pastorello and Krauss-Maffei extrusion machines. Extrusion machines and equipment are also shown by Burtonwood Engineering Co., Ltd., who are also exhibiting a 3½in thermoplastic extruder fitted with induction heating; Frieseke & Hoepfner G.m.b.H., represented in this country by Grilon & Plastic Machinery, Ltd., and W. Hopwood & Co., Ltd. Hard nickel electro-formed dies for moulds are shown by the London & Scandinavian Metallurgical Co., Ltd., with electro-formed shells for the slush or rotary casting of p.v.c.

The recently introduced range of nitrided guide pillars and bushes for injection, compression and die cast moulds shown by British Aero Components, Ltd., retain their hardness during repeated cyclic changes of temperature through a range extending up to 500 deg C. A selection of nitride hardened drill bushes and a centre groove hexagon bush developed for use with polyester glass fibre tooling are also shown.

Take-off machines in two sizes to admit up to 6 and 13in diameter profiles between caterpillars are shown by the Boston Marine and General Engineering Co., Ltd., incorporating Brook motors and Heenetron electronic equipment, and Fawcett Preston & Co., Ltd., are showing a caterpillar with a 5,000 lb pulling capacity and a 16in dual capstan having an electric wire speed indicator for return and straight through wire operation.

Mains frequency induction heating equipment is incorporated in a machine for preheating pelleted thermosetting plastic materials and rubber slugs prior to compression moulding, exhibited by Beanwy Electric, Ltd. Machines having a capacity up to 26 lb/hr are shown, with total loadings up to 1·25 kW.

Exhibits on the Metropolitan-Vickers Electrical Co., Ltd., stand include various forms of heating equipment used in the treatment of plastic articles and materials, a vacuum coating unit with which plastic materials can be covered with a decorative film, and a display of the irradiation of plastics. The company are also showing induction heated platens introduced at this exhibition for the first time, incorporated in the presses on the T. H. & J. Daniels stand.

The model SBP/40 de-flashing machine on the Guyson Industrial Equipment, Ltd., stand is on display for the first time in this country. Developed for the rapid removal of flash from thermoset plastic mouldings, the machine can also be used for matt finishing articles before painting. Endecotts (Filters), Ltd., are showing sieving equipment for testing, grading and measuring moulding powders and synthetic resins. Also on display are pack screens used in the manufacture of Terylene. Machines for sawing, milling, profiling and other shaping operations on plastics materials and products are being shown on the stands of Wadkin, Ltd., Danckaerts Woodworking Machinery, Ltd., and Interwood, Ltd.

A selection of instruments including anticipatory indicating temperature controllers and multi-point potentiometer recorders for indicating such variables as temperature, speed, strain and pressure are shown by Ether, Ltd.

H.F. Industrial Services, Ltd., are exhibiting a series of h.f. and v.h.f. plastic welding machines for use on p.v.c. which may also be used for the hot creasing of cellulose acetate and similar plastics. A fully programme-controlled plastic bag making machine which can apply hot wire cut seal, straightforward hot seal and impulse welding seals simply by changing jaws is being shown on the stand of Kemitype, Ltd. In addition, the machine can be connected to a h.f. generator for continuous h.f. welding.

The " Futura " machine for the continuous heat sealing of polyethylene, " Cellophane " and thin p.v.c. bags shown by M. L. Shelley & Partners, Ltd., incorporates a thermostatically controlled, automatically lubricated brass heating element. The sealing speed of the machine, which operates from a 220/240 V single-phase supply at a total loading of 350 W, is variable up to 400in per minute.

Among those companies exhibiting equipment for printing on plastic materials and articles are Milford Astor, Ltd., Dubuit, Ltd., and Phillips Bros. & Ellis, Ltd.

The Morane Plastic Co., Ltd., are showing a machine for laminating transparent plastic films to paper board and similar materials and a high pressure laminating press is electrically heated and water cooled and incorporates a thermostatic temperature control.

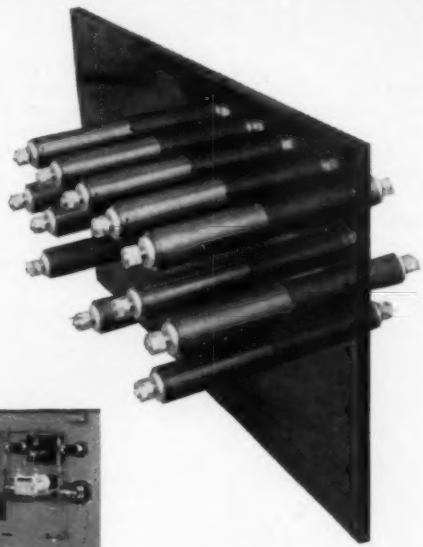
Products

A large part of the exhibition is devoted to finished products for both the industrial and domestic fields, illustrating the diverse applications of the many types of materials now available.

Among the new exhibits and applications being displayed for the first time by Permali, Ltd., is densified wood neutron shielding for nuclear power equipment. Other components made from plastic materials by the company and displayed include " Permali " electrical insulation components, " Aeromaster " adjustable pitch cooling tower fans, " Permacast " cast epoxy resin h.v. insulators and " Dialam " synthetic resin bonded paper and fabric h.v. bushings.

Included in the display of gearwheels, bearings, bobbins and bushes on the Tufnol, Ltd., stand are bearing pads employed to prevent corrosion due to electrolytic action between pipes and their supports. Instrument panels and control boards, insulating nuts, bolts and screws and bushings and moulded insulators and terminal boards are also displayed. Samples of materials and components, plastic coated to prevent corrosion, are shown by Durable Plastics, Ltd., including cable trays, conduit fittings and instrument cases.

The principal new items on the stand of Insulating Components & Materials, Ltd., are a range of standard miniature terminal bobbins which may be coupled together for transductor applications. A range of starter battery



A multi-way terminal board of " Tufnol " sheet and tube

The programme control box of the Kemitype, Ltd., bag making machine

containers known as the "Lorival Lightweight" and shown for the first time at the exhibition by United Ebonite & Lorival, Ltd., includes most popular sizes for British and Continental cars and two standard sizes for tractor batteries.

A range of terminal blocks from two to twelve way with up to 30 A continuous current rating, moulded in high dielectric black phenolic material and marketed in the United Kingdom by Precision Components (Barnet), Ltd., is shown on the Insulators, Ltd., stand. Also shown are various moulded through and pillar tags and a glass fibre inter-phase roof barrier used in Reyrolle 11 kV 500 MVA air-break circuit-breakers.

One of the major exhibits shown by Ekco Plastics, Ltd., is claimed to be the largest injection moulding so far produced in the United Kingdom, a lining for the recently announced Frigidaire 3·3 cu ft refrigerator. A wide selection of injection moulded, compression moulded and vacuum formed components is also displayed. A range of vacuum formed refrigerator cabinet linings and door panels is also being shown by the industrial department of Halex, a division of the British Xylonite Co., Ltd., with component mouldings for radio, television and other engineering trades.

Included in the display of mouldings in alkyd, p.t.f.e. and p.t.c.f.e. on the Kent Mouldings stand are bobbins for the electrical and textile industries, radio cabinets, valve bases and valve pin protectors and mouldings for television turret tuners, computer systems and a portable telephone hand-set.

Litholite Insulators & St. Albans Mouldings, Ltd., are showing a range of mouldings produced by compression, transfer and injection processes, including components for switches, control gear, domestic electrical equipment and mouldings for incorporation into busbar trunking systems. A selection of holders for strip lighting is featured and also a variety of terminal blocks, insulating bushes and switch handles. Applications of "Crystic" and "Marco" polyester resins in the electrical industry are shown by Scott Bader & Co., Ltd., including a panel-mounted 50 kV d.c. plug and socket connector cast by Miles Hivolt, Ltd.

Examples of glass reinforced epoxy resin core bolt insulation tubing and other vacuum formed and injection and compression moulded components are being shown by Thermo Plastics, Ltd., while Omega Plastics, Ltd., are exhibiting injection moulded components, including nylon gearwheels, high impact styrene electrical covers and vacuum formed components, including battery insulator covers and cases.

A wide range of products from storage and display containers to machine guards and refrigerator liners are shown by Olympic Plastics, Ltd., together with their latest television lamp, and among the Lacrinoid Products, Ltd., exhibits is a lampshade moulded from rigid polyethylene. Injection mouldings for industrial and domestic equipment are shown by Wilmot Breeden, Ltd., including a latch mechanism developed for refrigerator doors, and Hawley Products, Ltd., are showing a range of moulded articles which include radio equipment cases.

Among the manufacturers showing glass fibre reinforced mouldings are Bristol Aircraft, Ltd., whose display includes a fluted core radome and a cooling fan; W. & J. Tod, Ltd., whose exhibits include mountings for Marconi radio cabinets; and Flexo Plywood Industries, Ltd., who are also displaying a crystal oven fabricated from asbestos/phenolic material. Compressed fibre mouldings preformed under pressure and vacuum are being shown by Prestfibre, Ltd., including cases for television sets and various television tube end protector domes.

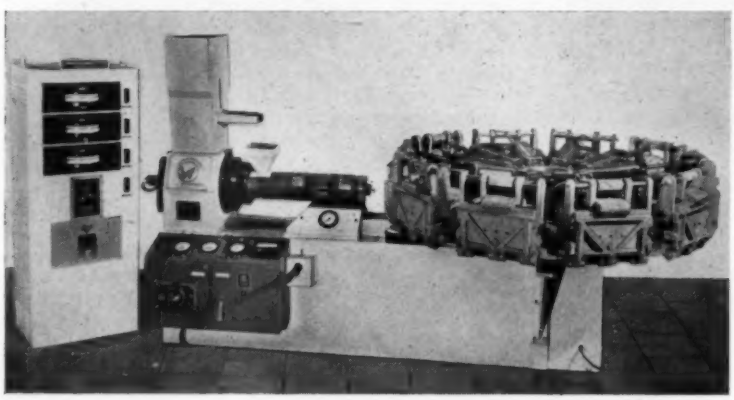
Polystyrene containers are among exhibits shown by the Plastic Box Co., Ltd., and the Cascelloid Division of the British Xylonite Co., Ltd., are displaying storage tanks, containers and bottles in a variety of materials, while Monsanto Chemicals, Ltd., are showing plastic wall and floor finishes and products used in the packaging industry. A knob fixing clip and a combination spring steel and nylon nut, both conforming to B.S. 415, developed for use with live electrical equipment, are shown by Simmonds Aerocessories, Ltd., with a variety of nuts, fixes and clips.

The Convention

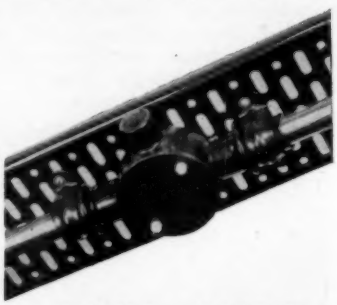
The sixteen papers being presented at this year's convention will be read during next Monday, Tuesday and Wednesday. Each of the papers presented will be followed by a period for questions and open forum discussion.

Two papers will be given on the subject of polyolefins. The mechanical and physical properties of polypropylene are discussed by J. M. Goppel, various types of polypropylenes being classified according to crystallinity and molecular weight and the various physical and mechanical properties of polymers given, particular attention being paid to tensile data, modulus and impact resistance. The moulding characteristics of polypropylene are being dealt with by G. Campbell. This material offers the moulder new and interesting properties, especially heat resistance, rigidity and apparently complete freedom from environmental stress cracking. Its characteristics will be discussed in relation to the choice of conditions for obtaining optimum properties in moulded articles.

Two papers will be presented on material developments. Liquid epoxide resins with their various hardening agents offer a unique combination of properties, but there are considerable handling difficulties associated with both the

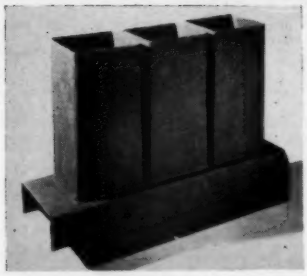


Foster Wucher low pressure injection moulding machine with ten-station table



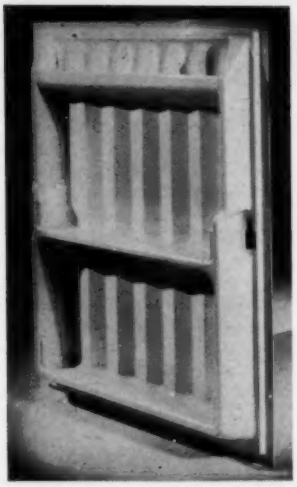
Steel cable tray and conduit with a corrosion-proof plastic coating

Left: Lorival container for a 12 V battery



Above: Insulators, Ltd., glass fibre barrier used in Reyrolle circuit-breakers

Left: High voltage connector cast by Miles Hivolt using "Marco" polyester resin SB.28C



Right: Refrigerator door liner vacuum formed in polystyrene sheet by Ekco Plastics, Ltd.

resins and the ancillary hardening materials. The paper presented by R. N. Lewis, "Some New Amine Hardened Epoxide Resin Systems and their Properties," discusses developments which have been made to overcome some of these difficulties. The second paper in this section, given by J. Benton, is concerned with some theoretical and practical aspects of block and graft copolymer syntheses.

In the section devoted to design trends, three designers, Robin Day of the United Kingdom, Count Sigvard Bernadotte from Scandinavia and Ernesto Rogers from Italy, will discourse on design trends in their respective countries with reference to plastics products. These three speakers form the panel of judges which will select the best design in the international design display, and it is expected that they will make some comment on their impressions of the exhibits.

Three papers dealing with recent developments in glass reinforced plastics are to be given. Roelf Tunteler gives a general survey of the present situation in the Benelux countries, special attention being paid to raw materials, resins, moulding methods and finished products. Developments in the United Kingdom are discussed by Brian Parkyn, whose paper will concentrate on reviewing advances in reinforcement resins, catalysts, pigments, premixes and dough moulding. Recent developments in processing and fabricating techniques are described. In the United States the advent of new resins and catalyst systems has commanded equivalent advances in reinforcement technology. The replacement of metal parts, where appropriate, provides a series of interesting case histories in product design, development and fabrication economics. In the paper presented by Harrison C. Blankmeyer, the practical concept of a development organisation to initiate and exploit opportunities in this field is described.

The paper given by Betty Lou Raskin on recent developments in foamed plastics in the U.S.A. will be the first in the section on expanded plastics. A brief explanation of foamed plastics will be given with an account of the status of rigid and flexible urethane foams, rigid polystyrene foam and rigid and flexible vinyl foams. Finally, some suggestions will be given for future investigations in foamed plastics research. The influence of bulk density upon the physical properties of expanded polystyrene will be discussed in the paper to be presented by W. B. Brown.

The final section is devoted to extrusion, a paper by D. A. Lannon and G. C. Karas discussing studies in the extrusion of thermoplastics, while the extrusion of acrylics is dealt with by L. Griffiths. At present, the outstanding application of extruded acrylics in Great Britain is in diffusing troughs for fluorescent lighting fittings.

Engineering Careers Booklet

A WIDE variety of opportunities in the engineering profession offered to young boys and girls about to leave school are outlined in "Professional Engineers," a new illustrated booklet published by the Central Youth Employment Executive in their "Choice of Careers" series (H.M. Stationery Office, price 1s 9d). It explains briefly how professional and practical engineers are trained, either by full-time or part-time study, sandwich courses and student or craft apprenticeships. There is a short description of the work that an engineer may do, including such aspects as research, development, design, production planning, installation, inspection, maintenance and plant operation.

Other chapters contain notes on the main branches—such as civil, electrical, municipal, structural, mechanical and aeronautical engineering—and on some aspects of the more specialised kinds. A brief account is given of the work of a few engineers and of the prospects for men and women in the engineering profession.

Electrolytic Capacitors

A NEW 10-page publication forming Part 2 of B.S. 2134 "Fixed Electrolytic Capacitors (Aluminium Electrodes) for Use in Telecommunication and Allied Electronic Equipment" has recently been issued, specifying patterns, sizes, values and ratings for a range of capacitors. In each voltage rating the range provides for a number of different values of capacitance in the form of either single or double capacitor units. Information on the use of electrolytic capacitors is given under the main headings: applied voltage, ripple rating, working temperature, re-forming, performance and storage at low temperature, negative connection, multiple units, insulating sleeves and clamping. The general requirements and tests for the capacitors are specified in the recently published Part 1 of this Standard.

Copies of Part 2 may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s.

E.T.U. POLICY CONFERENCE

IN his presidential address to the annual conference of the Electrical Trades Union at Bridlington last week, Mr. F. Foulkes said that the two issues which constituted their immediate challenge to the engineering employers were the 40-hour week and an increase in wages. Mr. Foulkes, who is the leader of the trade union side of the Negotiating Committee of the National Joint Industrial Council for the Electricity Supply Industry and will also be this year's president of the Confederation of Shipbuilding and Engineering Unions, said that the 40-hour week would be of greater lasting benefit to the workers than any other issue before them. But wages could not be neglected. Living standards must be raised and the increase in production must be reflected in the wage packet. More leisure with more pleasure must be their slogan.

On nationalisation, Mr. Foulkes said that while there were wholesale redundancies on the railways, and coal mines were being closed down, in 1958 the four nationalised industries paid out £179 million to financial interests. This burden had to be met by the workers employed in those industries, even before they started earning their own wages.

In conclusion, Mr. Foulkes said it was the fourteenth occasion on which he had addressed the conference from the presidential chair, and certain people had already decided that it would be the last. He was confident that the mutual trust existing between the majority of the members and the leaders of the Union would ensure that, following this year's elections, the Union would emerge stronger and more determined than ever and would continue to play its important role within the movement in the fight to achieve the complete and final emancipation of the British working class.

At the opening of the conference Mr. W. P. Blair, representing six Middlesex branches, sought to secure the amendment of standing orders to allow a discussion on the Union's finances for the past year. He said that the suggestion was made in view of imputations against the integrity of some members. Mr. W. T. Sullivan, of Dagenham, who recently raised the question of Union expenditure at a branch meeting after examining the account books, seconded. Mr. F. L. Haxell (general secretary) replied that an amendment of standing orders was quite unnecessary and that there would be the usual statement on financial affairs. On a show of hands the motion was heavily defeated.

The conference then quickly settled down to business, three resolutions being carried in rapid succession. The first called for an increase in the payment for working in abnormal conditions. The second urged the Executive Council to secure legislation to cover the inspection of all electrical equipment and new electrical installations, and periodic inspections of old installations, with powers to condemn all installations not attaining a satisfactory standard.

In the third resolution it was contended that protective clothing should be supplied to all manual workers.

Electrical contracting matters took up the Monday afternoon session. An amended resolution requested the Executive Council to make a further application to the National Federated Electrical Association for an improved ratio of apprentice labour to adult skilled operatives. A further amended resolution drew attention to the increasing practice of employers of requiring members to complete a registration form which asked for details of at least three past employments. This practice, the resolution stated, assisted the employers to draw up a black list of the more militant workers in the industry which could be used to deny them employment. The resolution, which was carried, urged that the full resources of the Union should be used to combat this form of "victimisation."

Another amended resolution wanted the Executive Council to negotiate with the N.F.E.A. a holiday pay scheme which would ensure at least two weeks' holiday with full pay. This was carried, as was a resolution to expedite negotiations for a sick pay scheme.

When a resolution calling for a substantial increase in wages for members in the contracting industry was debated, Mr. Haxell said that a further meeting with the employers had been arranged and it had been agreed that there should be no action on the ban on overtime and on strikes at selected sites until 29th June. Mr. Haxell expressed confidence that a settlement would be reached, but said that if not there would be a dispute which would continue until the Union got satisfaction. They were not prepared to go to arbitration because Government policy loaded it against them.

Concern was expressed by delegates at the excessive overtime still being worked in the contracting industry, in "complete disregard of overtime permits." The resolution, which was carried, called upon area secretaries to convene shop steward meetings so that the matter could be discussed in relation to unemployment and redundancy.

The conference then passed a resolution that negotiations should be initiated with the Electrical Contractors' Association of Scotland for seven days' notice on either side before termination of employment.

Reappraisal of Nuclear Power

THE view that the problems that Euratom had been formed to solve—a fuel shortage and insufficient dollars to meet it—had resolved themselves at least for the present and that Euratom should therefore concentrate on organising co-operative research rather than building nuclear power stations was expressed by Mr. Robert McKinney recently to the Parliamentary and Scientific Committee. Mr. McKinney was chairman of the Congressional panel on atomic energy three years ago and more recently the U.S. representative to the International Atomic Energy Agency in Vienna.

Discussing the coal crisis in Western Europe in relation to the Euratom nuclear power programme, Mr. McKinney concluded that as a result of the change in the price of coal and oil and the increasing availability of natural gas, Europe had no more immediate need of nuclear power than the United States or Russia. The Suez crisis had demonstrated the basic independence of Europe from oil deposits in any particular region. He thought that Euratom's programme of 15,000 MW by 1967 was now unrealistic and likely to be replaced by a more experimental programme of five or six 150 MW stations. These would provide design and operating experience to European countries but this revised pace of development would not pay material dividends to American technology under the United States-Euratom Agreement. He congratulated European supply companies on their caution in buying nuclear power stations and said that work in this field should proceed at a rate consistent with technological resources and developments and not be driven by the fear of an impending shortage of conventional fuel supplies.

VIEWS on the NEWS

By REFLECTOR

NO doubt many people were surprised when Mr. O. W. Humphreys, in his lecture-demonstration at the Torquay Power Convention, claimed that electric lighting could be cheaper than daylight. In real terms, he said, the cost of electric light was only about one-seventieth of what it was thirty years ago. In the same period building costs had risen sharply and buildings had to be designed to ensure adequate daylight for interiors. This was somewhat expensive and thus daylight was by no means free. Good artificial light enabled the architect to provide a bigger building for the same cost as a smaller one. However this may be I feel that I still prefer electric light to be auxiliary to, not a substitute for, daylight.

* * *

From time to time a brief news item records the "passing" of another of the smaller power stations that have given years of good service. Though the closing down of these stations is inevitable in these days of larger and larger generating units and ever-higher thermal efficiencies, to the men who have taken a pride in working in them there is always a feeling of regret. One which, according to *Regional Power* (the monthly magazine of the Eastern, London and South Eastern Region of the Central Electricity Generating Board), has been included in the "closing down in the near future" list for the past thirty years, is Bow generating station—now more than sixty years old. Mr. G. Clary, secretary of the Works Committee, says that this is apt to affect the morale of employees, making them look for transfer to more modern stations. In the past, it seems, such transfers have normally been by way of promotions to higher posts, for it is said that more engineers have "graduated" from Bow to become station and deputy station superintendents than from any other station in the country. Whether this is true or not I do not know, but the claim shows that the feeling of pride and attachment still exists, and I am glad that the station has been given a further lease of life. Two chimneys are to be rebuilt and a new compressor, smoke indicators and recorders installed.

* * *

With take-over bids very much in the news I was interested to hear last week from Mr. G. E. Walker, the secretary of A.E.I., the inside story of how that company was formed. The amalgamation of Metropolitan-Vickers and the British Thomson-Houston Co. in 1928 was, Mr. Walker emphasised, a deliberate act of management. It was not brought about by pressure of circumstances, and there was no question of one failing company being taken over by another stronger one. The companies were bitter rivals and there were strong personalities on both sides to whom the whole thing was a sort of "shot-gun wedding." This was a case for the most delicate handling on the human relations side.

One might have expected, Mr. Walker said, the formation of a new holding company in which the old companies would be associated as equal partners. Unfortunately, the accountants found a way by which they could use the unissued capital of Metropolitan-Vickers to save about £20,000 in stamp duty. The result was an announcement that Metropolitan-Vickers had bought B.T.H., which naturally aroused the fury of the B.T.H. men who not only thought they would be subordinate to their old rivals but that their American owners, who were behind the whole thing, had sold them up the river. When it was explained that the purchase was only a matter of form and that Metropolitan-Vickers was to be transmogrified into A.E.I., and that, in consequence, the Met-Vick factories would no longer belong to them but to A.E.I., the anger at Trafford Park exceeded that of Rugby.

The way it was done was to issue the unissued shares in Met-Vick to the shareholders of B.T.H. in exchange for their B.T.H. holdings; the name of Metropolitan-Vickers was changed to A.E.I.; and then a small subsidiary of Met-Vick had its name changed to the Metropolitan-Vickers Electrical Co., Ltd.; and (quite apart from the "new" Met-Vick being only a tenant at will in its own factories) they had, until the tangle was straightened out in 1951, a company with a £30 million a year turnover on a nominal paid up capital of £10,002 0s 6d.

Their American forbears might, Mr. Walker commented, have been astute business men, but they were not industrial diplomats. This experience provided a lesson from which A.E.I. had tried to profit in later years. As Mr. Walker wisely pointed out, it should always be borne in mind that although a company can neither laugh nor weep, nor lie awake at night and worry, those that direct it or work for it can.

* * *

Cooker hire began half a century ago although it faded out during the last war. The *Electrical Review* of 18th June, 1909, reported that:—

> "Some little time ago a mild sensation was created in the electrical press by the news that Mr. Chas. Furness, the borough electrical and tramways engineer of Blackpool, had decided to take the 'bull by the horns,' and initiate an electrical cooker hiring scheme in his area of supply. We understand that up to the present no very definite scheme has yet been put into operation, but experiments have been proceeding for some time with electrical cooking apparatus, and the conclusion has been arrived at that electrical cooking at 1d per unit of electricity can compare with the cooking by domestic gas ranges at 2s 6d per 1,000 cu ft. One of the most efficient ovens that has been tested at Blackpool was supplied by Mr. C. Fonteyn, of 76, Newman Street, Oxford Street, London, W., and in one of these ovens very efficient and satisfactory results were obtained, with the result that a hiring scheme will shortly be formulated at a rental of 3s to 4s per quarter. Should this rental be found insufficient to cover interest and maintenance charges, Mr. Furness will be quite content to make up the difference out of the charge for current, as he is not anxious to make any profit for the first 18 months on this scheme; he rightly takes the position that electric cooking must have a start somewhere, and that it would be a mistake to seek profits at this juncture by fixing prohibitive rentals."

INDUSTRIAL NEWS

Portuguese Power Station Contract

On 2nd June a contract was signed in Lisbon between Siderurgia Nacional S.A.R.L. and the Metropolitan-Vickers Electrical Export Co., Ltd., on behalf of A.E.I., and Babcock & Wilcox, Ltd., covering a complete power station for a steelworks to be built at Seixal, to the south-east of Lisbon. The steelworks will be built near the south bank of the River Tagus and it will be the first in Portugal. It is planned to be put in commission by the end of 1960 and initially to produce 250,000 tons of raw steel per annum, rising to 500,000 tons in 1964.

Dr. C. Dannatt, O.B.E., managing director of the Metropolitan-Vickers Electrical Co., Ltd., and also a director of A.E.I., and Mr. A. S. Peacock, of Babcock & Wilcox, Ltd., signed the contract on behalf of the contractors at a special ceremony. The total value of the contract is approximately £500,000.

The power station plant includes two 35 tons/hour integral furnace type boilers fired with blast furnace gas or oil together with the boiler house equipment supplied by Babcock & Wilcox, Ltd., delivering steam at 900 lb/sq in 900 deg F to a 14 MW single-cylinder steam turbine-generator and associated heat exchange equipment, supplying power at 6 kV 3-phase 50 c/s, to be manufactured by the A.E.I. Turbine-Generator Division. The boilers will be made at the Renfrew works of Babcock & Wilcox, Ltd., the turbine-generator will be made at the Trafford Park (Manchester) Works of Associated Electrical Industries, Ltd., and the associated heat exchange equipment will be made at the Germiston (Glasgow) Works of A.E.I. C. S. Allott & Son, Manchester, will be responsible for the design of the civil engineering works for the power station but the civil engineering work itself will be carried out by Siderurgia Nacional S.A.R.L.

Conclusion of the Portuguese power station contract, showing Dr. C. Dannatt signing for the Metropolitan-Vickers Co. With him, seated, are (left to right) Prof. Dr. Inocencio Galvão (Siderurgia Nacional), Mr. A. S. Peacock (Babcock & Wilcox), and Major Antonio Sebastião Ribeiro de Spinola (S.N.)

Common Market News Letter

The task of keeping informed on the progress of the Common Market and its relations with other countries, particularly Britain, is made easier (but rather expensive) by a monthly news letter being published by Britain in Europe, Ltd., 61, Catherine Place, Palace Street, London, S.W.1 (price £10 for twelve issues).

The latest issue, consisting of thirty-four duplicated foolscap pages, is a valuable collection of summaries of statements and articles published during March and April on the possible ways for associating the Common Market with other O.E.E.C. countries, and a record of commercial, financial and economic developments. Perhaps the most important of these for British industry, and transcending even the political discussions, is the rate at which trading agreements are being concluded between manufacturers and distributors in the Common Market.

Motorised Slewing Hooks

The motorised slewing "C" hook unit of 40 tons safe working load shown raising a load of hot slabs from the run-out table in the slab yard at the Abbey Works of the Steel Company of Wales, Ltd., was designed and built by Brown, Lenox & Co., Ltd., at their Pontypridd Works in South Wales. To facilitate handling the slabs, the hook can be rotated through 360 deg at 1·5 r.p.m. The top beam of the unit connects to the standard hooks of a twin-hook overhead electric crane, and the hook portion can be detached from the motorised section for use where no rotation is required. The drive is protected from the heat radiated from the hot slabs by shields, and rubber-cushioned couplings are employed to prevent shock loads being transmitted through the gear box. The motor is flange mounted, totally enclosed and weather-proof, and the gear box is a double-worm type with an additional frame attachable to the cover to house the motor.

Hot slabs being lifted by the slewing hook

Equipment of this kind can be supplied for safe working loads up to 70 tons, and for handling slabs up to approximately 20ft long by 4ft wide. The company recently published a 66-page booklet entitled "Chain and Lifting Gear," copies of which are available on request.

Plant for Australian Tanker

W. H. Allen, Sons & Co., Ltd., Bedford, announce that, in addition to supplying the two 600 kW back-pressure turbo-alternators for a new 32,350-ton oil tanker to be built in Australia for the Ampol Petroleum Co., Ltd., of Sydney, they have also received a contract for a 6-cylinder, 750 r.p.m., four-stroke diesel engine driving a 200 kW Allen alternator for installation in the same vessel.

Fire Protection Conference

A National Fire Protection Conference will be held in London in February, 1960. It has the support of the Home Office and the Ministry of Labour and National Service and participation is expected from representatives of a wide variety of interests including both public and industrial fire services. It is hoped that the Conference will provide scope for an

exchange of ideas and establish a closer liaison between those whose concern is to prevent fire. Anyone wishing to attend should ask for further particulars from the Secretary, Fire Protection Association, 31-45, Gresham Street, London, E.C.2.

Impregnated Pressure Cable in New Zealand

An underground cable contract has just been completed for the Auckland Electric Power Board by the B.I.C.C. organisation. At 110 kV, the three-core impregnated pressure cables are the highest voltage cables in use in New Zealand. Two feeders, each some 11,300 yd in length, connect the Penrose and Queen's Quay substations and will provide an additional link when the King's Wharf station is shut down and the load is transferred to the new Mercer steam station.

The three-core cables have a cross-sectional area of 0·2 sq in and are sheathed in a seamless aluminium tube. The overall diameter of the cable is 3·99in and the weight 23·8 lb per yard. The order was received through the B.I.C.C. agents, the National Electrical & Engineering Co., Ltd., and the installation was supervised by B.I.C.C. Construction (New Zealand), Ltd.

B.T.H. 16 mm Projectors

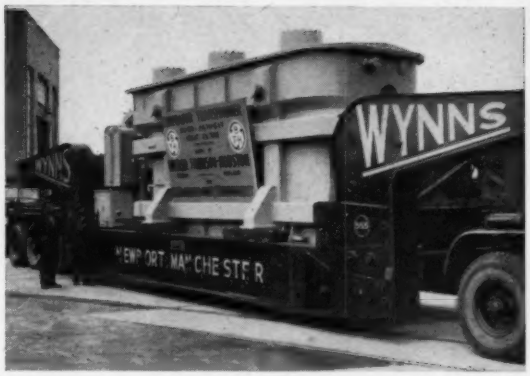
Sound-film equipment made by the British Thomson-Houston Co., Ltd., is being used in a novel manner at international exhibitions to publicise British achievements. By a unique arrangement of four standard model 451 magnetic-optical 16 mm projectors it is possible to present sound films with fully synchronised commentaries in four different languages. The system attracted large audiences to the United Kingdom Atomic Energy Authority stands at the "Atoms for Peace" Exhibition, Geneva, and the Milan Fair, and it was demonstrated recently for the first time in Great Britain on the "Educational Foundation for Visual Aid" stand at the Photo Fair, Olympia. The spectators are provided with lightweight earphone sets with a volume control and a switch by which the language desired for the commentary can be selected.

Brit.I.R.E. Convention

The 1959 Convention of the British Institution of Radio Engineers will be held at the Cavendish Laboratory, Cambridge, from 1st to 5th July, when a number of papers on television engineering in science, industry and broadcasting will be read and discussed. The opening address on 1st July will be given by the president, Professor E. E. Zepler.

Transformers for Berkeley

The first two of four 100 MVA 11·8/141·6 kV generator transformers for the C.E.G.B. nuclear power station at Berkeley, Glos., recently left the British Thomson-Houston Co.'s Rugby Works. The transformers are for direct connection between the turbo-alternators and the 132 kV grid. They are forced water cooled and complete with on-load tap-change gear. Each transformer weighs 126 tons and they were taken to the site by road on a Wynns twenty-four wheel trailer, with push and pull tractors.



B.T.H. 100 MVA generator transformer en route for Berkeley power station

Approved Contractors

The third edition of the Roll of Approved Electrical Installation Contractors has been issued by the National Inspection Council for Electrical Installation Contracting, Aldine House, 10-13, Bedford Street, London, W.C.2. As before, the body of the publication is occupied by a geographical guide to contractors and there are alphabetical indexes to contractors and to towns. The introduction claims that "there is an approved contractor within reach of everyone."

Semiconductors

A booklet giving an introduction to the principles and materials of semiconductors, and briefly surveying the more important present-day uses of these devices with some indications of possible future developments, has been published by Johnson, Matthey & Co., Ltd., 73-83, Hatton Garden, London, E.C.1. After the various basic forms of the devices have been described, diodes and rectifiers, including switching diodes, photodiodes and low and high current rectifiers, are dealt with, followed by a section devoted to the various forms of transistor, including point contact, junction and photo transistors. Hall effect and thermo-electric devices are briefly mentioned, with thermo-electric refrigeration and power generation. The booklet concludes with a list of Johnson Matthey products for use in these devices, including high purity materials and alloys.

Works Visit

The Senior Trade Commissioner for New Zealand, Mr. G. R. J. Hope, visited the Bedford factory of Brookhirst Igranic, Ltd., on 27th May to see work being completed on a motor control centre for the Alliance Freezing Co., of Invercargill, New Zealand. The plant will process sheep and cattle from the moment of slaughter to the point of mechanised loading into cold storage. The control centre will be made up of 16 cubicles: six drive control cubicles; three auxiliary control cubicles for the cold storage equipment; six ring main cubicles for services such as lighting; and one conveyor control cubicle, governing

North British Type 2, 1,000 h.p. main-line diesel-electric locomotive with a designed top speed of 75 m.p.h. The electrical equipment has been supplied by the General Electric Co. Thirty-eight of these locomotives have been ordered by the Eastern Region of British Railways

Mr. G. R. J. Hope, Senior Trade Commissioner for New Zealand (centre) at the Brookhirst Igranic Bedford works

the starting and stopping of the conveyors in the correct order. A second motor control centre for New Zealand is now being designed at the Bedford works. This is for the Christchurch Drainage Board and will be made up of 17 cubicles in an L-shape. Another New Zealand contract at present in hand is for a considerable extension to the municipal pumping control gear in Wellington, which Igranic designed and manufactured.

Ferranti Pegasus Order

Ferranti, Ltd., has received an order from Bruce Peebles & Co., Ltd., for a £60,000 Pegasus digital computer. Initially, the Pegasus will be used for fundamental research and design calculations, but it is also capable of undertaking work in a wide range of fields, such as production and stock control, sales analysis and statistics. Although priority will be given to Bruce Peebles's own work, the machine will be made available to any other local firms or organisations.

Electronics in the Plastics Industry

The control cabinet for plastic film stretching equipment shown on page 695 of our issue of 10th April was manufactured by the Electric Construction Co., Ltd.

Change of Name

From 1st July next Besson & Robinson, Ltd., will change their name to B & R Relays, Ltd.

Corrosion Engineers' Association

At a luncheon given under the auspices of the *Corrosion Engineer* at the Rembrandt Hotel, South Kensington, on 29th May, Mr. H. M. Powell, who is technical director of Cathodic Corrosion Control, Ltd., and chief electrical engineer of the Constructors John Brown organisation, announced the formation of the British Association of Corrosion Engineers. The objects of the Association will be generally to promote the dissemination of technical information about corrosion matters and to develop by means of social activities the free interchange of information among members. In due course the Association will progress towards the establishment and acceptance of suitable qualifications for corrosion engineers, and the promotion of standardisation in the terminology and techniques of corrosion control. When the Association is in full operation it is intended to hold meetings with papers, films and discussions. Details and membership application forms can be obtained from the hon. secretary, British Association of Corrosion Engineers, 97, Old Brompton Road, London, S.W.7.

International Labour Conference

The protection of workers against radiation, collaboration between public authorities and employers' and workers' organisations at the industrial and national levels and a general discussion on problems of non-manual workers, including technicians, supervisory staff, etc., are amongst the items on the agenda to be considered at the 43rd session of the International Labour Conference which opened in Geneva on 3rd June and is expected to continue until 25th June.

London Wholesalers' New Premises

After nearly twenty-five years of service from Harrow Road, London, W.2, the Winter Trading Co., Ltd., electrical wholesalers, moved on 4th May to 95-99, Ladbroke Grove, London, W.11 (telephone: Park 1341). The new, self-contained building brings all departments under one roof and provides nearly 20,000 sq ft of storage space alone. Easily accessible from all parts of London, the position provides excellent loading and unrestricted parking facilities. The four provincial branches of the company will continue to provide the same service in their respective areas.

The new London premises of the Winter Trading Co., Ltd.

L.E.W. Sales Conference

The annual sales conference of the London Electric Wire Co. & Smiths, Ltd., group of companies was held recently at Eastbourne. Mr. E. L. Wildy, chairman and managing director, presented the inter-branch turnover competition trophy to Mr. J. W. Hunter on behalf of Newcastle branch. On the following day a golf tournament was held at the Royal Eastbourne Golf Club, when the "Terry" cup was won by Mr. M. C. W. Wildy, secretary to the company.

Laboratory Equipment for Indian Steelworks

Baird & Tatlock (London), Ltd., who were appointed consultants to the Indian Steelworks Construction Co., Ltd. (Iscon), for the laboratories of the Durgapur steelworks, have now been appointed contractors for the supply of all the laboratory apparatus, chemicals and equipment for laboratories of these steelworks.

Educational

Particulars of a course for the diploma in technology in electrical engineering at the Bradford Institute of Technology are available from Dr. G. N. Patchett, head of the Department of Electrical Engineering of the Institute, Bradford, 7.

A summer school on fundamentals of transistor theory and applications will be held from 13th to 17th July at the Borough Polytechnic, Borough Road, London, S.E. Particulars can be obtained from the Principal.

Laminated Tubes

A wide range of various grades and qualities of laminated tubes for the electrical industry is manufactured by Langley (London), Ltd., in their works

at Kelvin Way, Crawley, Sussex. Tubes can be supplied in standard lengths or cut, fabricated or machined in accordance with drawings, and special grades are available with controlled mechanical properties for a wide range of applications. A display case containing samples of these tubes is available, on request to the company, with a set of data sheets describing them and giving their electrical and mechanical properties. The general classification of the tubes in the case and the British Standards specifications with which they are detailed inside the lid.

Big Rise in Domestic Appliance Sales

Sales by radio and electrical goods shops in April were 23 per cent higher than a year earlier while those by the radio and electrical departments of department stores showed an increase of 45 per cent. A major influence in this strong upsurge in retail sales was the Budget which came at the beginning of the month. Though the reductions in purchase tax were small they ended a period of uncertainty which had probably led to some postponement of purchase in preceding weeks. The index numbers and percentage changes were given in last week's *Board of Trade Journal*.

U.S. Ruling on Turbines

The United States Office of Civil and Defense Mobilisation ruled last week that American security is not threatened by imports of heavy electrical equipment. This amounts to a complete rejection of the American manufacturers' case for a virtual embargo on imports of hydraulic turbines and generators, transformers and circuit-breakers. The Office has still to find on a further petition affecting steam turbines and generators.

Industrial Outlook Brighter

A general improvement in the business situation as compared with four months ago is revealed by the replies to the Federation of British Industries' latest inquiry into current industrial trends. The inquiry (the fifth) was carried out at the beginning of this month and replies were received from 700 firms representative of British industry both in size and type of output.

Of these firms, 59 per cent feel more optimistic about the general business situation, and only 4 per cent less optimistic, than they did in February. Half of them report that new orders are coming in at a faster rate and the downward trend in export orders in February has now been reversed: 27 per cent report an increase against 19 per cent a decrease. The output of 46 per cent of the firms has risen and 41 per cent remained the same. Though the present level of output of 60 per cent of the firms is still below capacity this is a smaller percentage than in February. The decline in stocks of raw materials, which was a feature of previous inquiries, is now hardly significant. Reductions in selling prices now outweigh increases and, as costs are steadying, 42 per cent report a fall in profit margins. Capital investment is not sharing in the general expansion. Expenditure authorised for plant and machinery in the next twelve months is expected to be no more than in the previous twelve months, and for building not as much.

Trade Announcements

British Insulated Callender's Cables, Ltd., announces that its Lincoln branch office is now at Holmes Road, Lincoln. The telephone number (Lincoln 21351) is unchanged.

Webster Wood Products (Chiswick), Ltd. (which last year acquired the Electrical Woodware Department of the West London Timber & Moulding Co., Ltd.), has moved to larger premises at 192b, Chiswick High Road, London, W.4 (telephone: Chiswick 4213).

The premises of the **A.E.I. Lamp & Lighting Co., Ltd.**, at Princes Dock Street, Hull, have been closed and the Leeds office at 46, Wellington Street, Leeds, is now dealing with all communications in the Hull area.

Matthews & Yates, Ltd., have transferred their Birmingham office to Smithfield House, Digbeth, Birmingham, 5 (telephone: Midland 7284).

Mr. J. S. Adgey, of Joseph Ballentine (Belfast), Ltd., 23, Bedford Street, Belfast, has been appointed Northern Ireland agent for **Chilton Electric Products, Ltd.**, as from 1st July next.

The **Anglo-Netherland Technical Exchange, Ltd.** (A.N.T.E.X.), has acquired larger premises at 7-8, Idol Lane, London, E.C.3 (telephone: Mansion House 2716), to deal with home and export orders for its miniature soldering irons.

Mr. D. J. Hopley, The Grange, Walton, Stone, Staffs. (telephone: Stone 11 or 550), has been appointed technical representative of **Londex, Ltd.**, to cover the area Cheshire, North Staffordshire, Flintshire, Caernarvonshire, Denbighshire and Anglesey.

Parliamentary Report

Replying to a question by Mr. E. Fletcher, Mr. Nugent, Parliamentary Secretary to the Ministry of Transport, said the London Travel Committee had not yet completed its examination of the proposed Victoria-Walthamstow underground railway and of the benefits of comparable expenditure on alternative works which would help travel in London. The report was not expected for some weeks. Urged that the scheme, which had been approved in principle, should be started as soon as possible, Mr. Nugent said that what had not yet been approved in principle was the spending of the £50 or £60 million necessary for building the tube. The Ministry was not yet sure whether the money could be spent better in other ways to improve travel in London.

Hydraulic Research

Asked by Lieut.-Col. Cordeaux what facilities were available within the Department of Scientific and Industrial Research to help in the design of hydraulic machinery which could be efficiently used in hydro-electric pumped-storage schemes, Mr. H. Nicholls, Parliamentary Secretary to the Ministry of Works, said the National Engineering Laboratory of the Department had, for this purpose, installed special rigs for testing pump models up to 300 h.p. very accurately over a wide range of working conditions, including those met with in pumped storage schemes.

Consumer Protection

Sir David Eccles, President of the Board of Trade, announced the formation of a committee to consider the question of consumer protection. He said the chairman of the committee would be Mr. J. T. Moloney, Q.C., and its object would be to review the working of the existing legislation relating to merchandise marks, and to consider and report what changes in the law and what other measures were desirable for the further protection of the consuming public. The membership of the committee would be announced as soon as possible.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 22nd JUNE

Tadworth.—Walton Heath Golf Club. Electrical Industries Club. Golf day.

WEDNESDAY, 24th JUNE

London.—Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Luncheon. Speaker, Sir Christopher Hinton.

THURSDAY, 25th JUNE

Croydon.—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "Electrical Recording Instruments," by H. W. Griffiths.

Hove.—New Imperial Hotel, 7.30 p.m. A.S.E.E. Brighton, Hove and District Branch. Film, "Bakelite Materials."

Kingswood. — Kingswood Golf Club. A.S.E.E. Golfing Society. St. Helen's Trophy.

London.—At the Institution of Civil Engineers, Great George Street, S.W.1, 5.30 p.m. Institution of Electrical Engineers. Meeting of corporate members to consider resolutions for increases in entrance fees and annual subscriptions.

St. Ermin's Hotel, Westminster, 10.30 a.m. Combustion Engineering Association. Southern Region Meeting. Brains trust on "The Working of the Clean Air Act."

Trawsfynydd Nuclear Power Station

THE Central Electricity Generating Board has issued a letter of intent to Atomic Power Constructions, Ltd., to enter into a contract for the design, construction and commissioning of a complete 500 MW nuclear power station at Trawsfynydd, Merionethshire. The contract also includes a development scheme for Port Madoc Harbour, which will enable many of the heavy items of plant and equipment to be delivered to the site by sea. Atomic Power Constructions, Ltd., was formed at the end of 1956, the member companies being Crompton Parkinson, Ltd., Fairey Aviation, Ltd., International Combustion (Holdings), Ltd., and Richardsons Westgarth & Co., Ltd., in association with Nuclear Civil Constructors. The last firm is a partnership of Trollope & Colls, Ltd., and Holland & Hannen and Cubitts, Ltd.

The Trawsfynydd site is on the northern shore of the artificial lake of that name which was created about 30 years ago to serve as a storage reservoir for the Maentwrog hydro-electric power station. This lake is large enough to provide the 35 million gal/hr of cooling water which will be required by the nuclear station.

The land, which is owned by the Generating Board, is rocky and broken and of no agricultural value. The reactors will be built direct on rock foundations. The station will be connected by overhead line to the 275 kV supergrid at the Ffestiniog pumped storage station now under construction five miles to the north. Since the site is within the North Wales National Park careful consideration has been given to the design of the buildings to ensure that they will blend with their surroundings. Mr. Basil Spence, president of the Royal Institute of British Architects, is the architectural consultant for the project.

The station will contain two graphite-moderated gas-cooled natural uranium fuelled reactors operating on the same principle as those in the stations already being built for the C.E.G.B. Each graphite moderator will contain 3,720 vertical fuel element channels and will be contained in a spherical steel pressure vessel of 61ft internal diameter, fabricated from 3½in thick steel plate. Both reactor pressure vessels and a 400 ton Goliath crane to be used during construction of the station will be provided by Babcock & Wilcox, Ltd., acting as sub-contractors to Atomic Power Constructions, Ltd. Heat will be removed from the reactor by means of CO_2 at a nominal pressure of 240 p.s.i. Six heat exchangers will be provided for each reactor placed in line in two groups of three on opposite sides of the pressure vessel. Each boiler will be 18ft internal diameter and 116ft high and will contain six sets of tube banks. Each boiler will be associated with a 6,000 h.p. single stage axial flow fan for circulating the CO_2. The circulators will be directly driven by 2,950 r.p.m. induction motors and the gas flow will be regulated by linked throttle valves in the main gas ducts and by-pass valves in the recirculation ducts.

Each reactor building will contain a reactor and its associated boilers and will occupy an area of about 300ft by 180ft at ground level and will be 179ft high. Each boiler, with its associated gas ducts, is individually shielded along its entire length by shield walls which connect with the biological shield of the reactor itself. At boiler plinth level the building is extended to form a common circulating house containing the electric motors for the gas circulators. Charge machines will be provided to permit fuelling while the reactor is on load. Each machine is a composite unit capable of carrying out all operations connected with fuel handling and is 64ft high with a weight of about 380 tons. Control of the station during normal operation will be carried out from a central control room situated between the two reactor buildings.

The four 145 MW turbo-generators will be arranged transversely in the turbine house which will be 450ft long and 220ft wide. The turbines will be 4-cylinder units designed for a dual pressure steam cycle, the steam conditions at the h.p. and l.p. turbine stop valves being 927 p.s.i. at 715 deg F and 290 p.s.i. at 685 deg F respectively. The generators will have water cooled stator windings.

Mining Engineers' Convention

A COUNCIL meeting followed by an informal reception opened the proceedings of the annual convention of the Association of Mining Electrical and Mechanical Engineers held at Newcastle-upon-Tyne last week (9th to 12th June) and attended by some 500 members and their ladies. On Wednesday morning the Association's annual general meeting took place and Mr. Ernest Loynes, divisional chief electrical engineer, North Western Division, National Coal Board, was elected as the new president in place of Mr. S. Winstanley. Mr. Loynes then delivered his presidential address which was entitled "Technicians in Engineering and Mining." In the afternoon a paper on mechanical handling underground was presented by Mr. T. E. Green, chief traction engineer, National Coal Board, and Mr. N. Higginson, divisional mechanical engineer, West Midlands Division, N.C.B. The M. W. Thornton memorial lecture was delivered on Friday morning by Mr. H. T. Ramsay, director of the Safety in Mines Research Establishment, and he dealt with international mines safety research.

Mr. S. Winstanley presenting the badge of office to the new president, Mr. E. Loynes

The annual golf tournament for the "Heyes" trophy was held at Gosforth Golf Club on Thursday and there were a number of visits to nearby works. The factories visited included those of A. Reyrolle & Co., Ltd., C. A. Parsons & Co., Ltd., Swan, Hunter & Wigham Richardson, Ltd., Victor Products (Wallsend), Ltd., Hugh Wood & Co., Ltd., and Wright, Anderson & Co., Ltd. The president's reception and the annual banquet and ball on Friday evening brought the proceedings to a close. We hope to publish a fuller account of the Convention in our next issue.

KENT COAST ELECTRIFICATION

Completion of First Phase

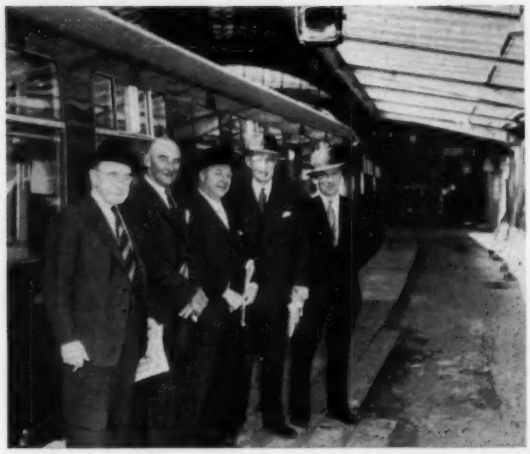
THE first electric train to carry passengers to the Kent coast was run from Victoria, London, to Ramsgate on 9th June. This express was one of the new style specially built trains which last Monday started running an hourly service between London and the Thanet towns.

This instalment of the British Railways modernisation plan is the first phase of the expansion of electric traction over the Southern Region's lines in North-East Kent from the present terminating point at Gillingham to the coastal towns through Faversham to Margate and Ramsgate and from the junction at Faversham via Canterbury to Dover. The next phase is the modernisation and electrification of the remainder of the South-Eastern Division of the Southern Region, including the main line through Tonbridge and Ashford to Folkestone and Dover.

The new lines are electrified at 750 V d.c. as opposed to the 660 V system on the suburban, Brighton, Portsmouth and Maidstone lines. The third rail system has, however, been retained. Power is supplied from the Area Board's 33 kV or 66 kV network and fed through railway-owned, oil-filled cables to convertor substations. Twenty-three substations and 21 track paralleling huts have been constructed. They are all unmanned and are remotely controlled from a new control room at Canterbury.

New multiple stock units and locomotives have been built by British Railways at their Eastleigh works. Fifty-three four-coach multiple units have been built, consisting of two power coaches and two trailing coaches. Thirteen 2,500 h.p. electric locomotives have also been built; these were described in the *Electrical Review* of 15th May last. These locomotives will haul the "Night Ferry" boat train, some passenger trains and heavy truck freight trains. The remainder of the freight trains will be hauled by 45 diesel-electrics which weigh 25 tons and have 1,550 h.p. engines.

Twenty-seven bridges have had to be either widened, extended or completely rebuilt to accommodate the new lines and 35 stations were partially rebuilt. Semaphore signalling on the Kent coast lines has been replaced by colour light signalling and eight modern signalling boxes have been built. Seven of these new boxes are equipped with route-setting operating panels.



Five successive electrical engineers concerned with the development of electric traction since 1912 on the Southern Region of British Railways, at Victoria Station, London, on the return of the inaugural electric train to Margate. Left to right: Mr. A. Raworth, Mr. C. M. Cock, Mr. S. B. Warder, Mr. H. H. Swift and Mr. W. J. A. Sykes. Mr. Raworth was concerned with developments up to 1945, which included the electrification of the main lines to Brighton and the Sussex coast and from London to Portsmouth

New electric rolling stock for the Kent coast electrification leaving St. Mary Cray station and (right) interior of the driver's cab

PERSONAL AND SOCIAL

News of Men and Women of the Industry

As we go to press, we learn that **Mr. Leslie C. Gamage,** M.C., M.A., chairman and managing director of the General Electric Co., Ltd., has had a knighthood conferred upon him in the Birthday Honours published on Saturday last. Other well-known electrical men who have received awards include **Mr. F. H. S. Brown,** B.Sc., M.I.Mech.E., M.I.E.E., a member of the Central Electricity Generating Board, and **Mr. J. Henderson,** M.C., B.Sc., A.R.T.C., M.I.E.E., chief engineer of the South of Scotland Electricity Board, who become Commanders of the Order of the British Empire (C.B.E.).

Mr. L. C. Gamage

The Minister of Power has reappointed **Mr. D. B. Irving,** B.Sc., M.I.E.E., as chairman of the London Electricity Board.

A *Reuter* message from Hong Kong states that **Mr. J. Mould,** former chairman of the East Midlands Electricity Board, has been appointed chairman of the Commission set up to advise the Hong Kong Government on the form and extent of the control to be imposed on the Colony's two power companies, the Hong Kong Electric Co., Ltd., and the China Light & Power Co.

Mr. Felix Rogers, M.B.E., has retired from the position of head of the Apparatus and Installation Equipment Department of the British Electrical and Allied Manufacturers' Association, but he has agreed to serve B.E.A.M.A. in a part-time capacity as continental liaison officer for the Domestic Appliances Division, in which position he will watch the interests of the electrical domestic appliance manufacturers in the European market.

Mr. F. Rogers

Mr. Rogers, who has been with the B.E.A.M.A. for twenty-two years, was born in 1894 and educated at the Regent Street and Woolwich Polytechnics. His training in electrical engineering was received with James Keith & Blackman, Ltd. After gaining experience as a draughtsman with Siemens Brothers & Co., Ltd., he became chief of the Estimating Department at the International Electric Co., Ltd. Early in 1922 he joined Marconi's Wireless Telegraph Co., Ltd., as chief of the Works Estimating Department and was responsible for the administrative production of many of the early broadcasting transmitters. After working on the continent as managing director of Etabs. Laporte (SA), Paris, he became secretary of the Electrical Fair Trading Council in 1933.

In 1948 Mr. Rogers was awarded the M.B.E. for his work in connection with the electrical equipment of prototype houses. He was a member of the advisory committee of the "Britain Can Make It" Exhibition and was on the Lighting Fittings Advisory Committee of the 1951 Festival of Britain. At the time of his retirement Mr. Rogers was chairman of the B.E.A.M.A. Commercial Electrical Catering Apparatus Section and Associated Manufacturers of Domestic Electrical Appliances, a member of the Electrical Fair Trading Council and numerous other committees in the electrical industry. Until 1957 he was director of the Electric Light Fittings Association.

Mr. K. A. Ballard has joined the Sandiacre Screw Co., Ltd., as London manager of the newly opened London office at 70, St. Stephen's House, Victoria Embankment, S.W.1. Mr. Ballard was formerly with Samuel Osborn & Co., Ltd., and the A.P.V. Co., Ltd.

The Council of the City and Guilds of London Institute has conferred the Fellowship of the Institute (F.C.G.I.) upon the following past students of the City and Guilds College in recognition of their distinguished contributions to industry or the professions in which they are engaged:—**Mr. P. Adorian,** M.I.E.E., M.Brit.I.R.E., A.F.R.Ae.S., managing director of Associated Rediffusion, Ltd., for pioneer work in relaying broadcasts, etc.; **Mr. L. G. Brazier,** A.C.G.I., B.Sc., Ph.D., M.I.E.E., A.F.R.Ae.S., F.Inst.P., director, and director of research and education, British Insulated Callender's Cables, Ltd., for research in connection with electric cables, in particular, high voltage underground transmission; and **Mr. G. S. C. Lucas,** O.B.E., M.I.E.E., director and chief engineer, British Thomson-Houston Co., Ltd., for radar and electronic research, and services to technical education.

Major-General J. L. P. Haines, C.B., C.B.E., who has been managing director of Aron Electricity Meter, Ltd., for the past seven years, has decided for reasons of health to relinquish his appointment with effect from 30th June. To succeed him the board has appointed **Mr. H. R. Whitfield,** M.I.E.E., who has been in charge of the Electronics Division of the Plessey Co., Ltd. Before joining the Plessey Co. Mr. Whitfield was associated with Kelvin & Hughes, Ltd., for thirteen years. The Plessey Co. has agreed to release Mr. Whitfield to take up his new appointment on 1st July.

Mr. L. V. Turner, of Taunton (Somerset), who has been a part-time member of the South Western Electricity Board since 1951, has retired after forty-seven years' service in the electricity supply industry. At a luncheon recently in Torquay, Mr. A. N. Irens, chairman of the Board, on behalf of his fellow Board members and chief officers, presented Mr. Turner with an inscribed silver cigarette box.

Mr. L. V. Turner

Mr. Turner is a past-chairman of the South Western Sub-Centre of the Institution of Electrical Engineers, and of the South West England and South Wales Area of the E.D.A. He received his early technical training with Newton's of Taunton, and then served as a power station engineer at Croydon and later in Kent. From 1919 to 1948 he was with Taunton Corporation Electricity Department, being appointed borough electrical engineer and manager in 1936. He became Taunton's sub-area manager of the South Western Electricity Board in 1948, retiring from that position on being appointed a part-time member of the Board in 1951.

Sir Lawrence Bragg, O.B.E., F.R.S., has been appointed by the Council of the Royal Society as Rutherford Memorial Lecturer for 1960, to deliver the lecture in New Zealand.

Mr. B. A. Christie has joined I.T.D., Ltd., and will take up the appointment of managing director of that company on 17th June. On the same date the following executive officers of the company will be appointed associate directors: **Messrs. L. A. Rochefort** (general manager), **A. C. Cooper** (general sales manager) and **R. J. Stokes** (secretary).

Mr. F. Brassington, A.M.I.E.E., has joined the boards of Bescol (Electric), Ltd., and Smiths Switchgear as sales

director for both companies. He was formerly deputy chief electrical engineer of the Metals Division, Imperial Chemical Industries, Ltd., Witton, Birmingham.

The Export Credits Gurantee Department announces that the President of the Board of Trade has appointed the **Hon. S. G. Catto** and **Sir Stanley Harley** members of the Department's Advisory Council. The Hon. S. G. Catto is a managing director of Morgan Grenfell & Co., Ltd., and is also a director of the General Electric Co., Ltd. Sir Stanley Harley is chairman and managing director of the Coventry Gauge & Tool Co., Ltd. He is president of the Gauge and Tool Manufacturers' Association.

Mr. H. C. Siddeley, M.I.E.E., writing from Argentina, tells us that he and Mrs. Siddeley celebrated their diamond wedding this week. They were married at St. Paul's Church, Sale, Ches., on 15th June, 1899. Our older readers will remember Mr. Siddeley as former London manager for the Lancashire Dynamo & Motor Co. He went to Argentina in the early 'thirties as representative of the British Electrical and Allied Manufacturers' Association, later joining the engineering department of H. A. Roberts & Co., Buenos Aires. We extend our heartiest congratulations to Mr. and Mrs. Siddeley. Mr. Siddeley was chairman of the Argentina Branch of the I.E.E. in 1937-38 and 1946-47.

Mr. W. M. Tribute, F.S.M.A., late export advertising manager of Hoover, Ltd., has recently been appointed chairman of the Royal Counties Branch of the Incorporated Sales Managers' Association.

Harris & Sheldon (Electrical), Ltd., have announced the following additions to their staff:—

Mr. H. M. Hume, has been appointed chief lighting engineer, Birmingham. He joined Scottish Cables, Ltd., Renfrew, in 1942 and in 1947 went to Philips Electrical, Ltd., being appointed manager of Philips Lighting Service Bureau in Calcutta in 1955.

Mr. H. A. Turner, who is area engineer, South-West England, received his training with the General Electric Co., Ltd., at Cardiff and was appointed lighting engineer and departmental manager with the G.E.C. at Swansea, in 1937. After war service he rejoined that company at Swansea, and in 1949 was appointed lighting engineer and departmental manager at Bristol. Mr. Turner has been secretary, chairman and is now treasurer of the I.E.S. Bath and Bristol Centre.

Mr. A. C. Johnson, who has been appointed area engineer, North West England, commenced his career with Crompton Parkinson, Ltd., in 1946 and joined the G.E.C. in 1951, with whom he was appointed lighting departmental manager at Blackburn. He left the G.E.C. for Ekco-Ensign Electric, Ltd., in 1956 but shortly afterwards took the position of lighting engineer to the C.W.S., Manchester.

Mr. R. A. Chappell, Graduate I.E.E., who is in the London area, won the Bronze Medal for the City and Guilds Internal Lighting Examination in 1956, and before joining Harris & Sheldon (Electrical), Ltd., was with Falk, Stadelmann & Co., Ltd.

Plannair, Ltd., has appointed **Mr. J. H. Browne** as sales executive; he will specialise in air movement applications for the electronic and aircraft industries. Mr. Browne has been with the company since its inception, latterly as contracts manager. **Mr. A. W. Dean** takes over as contracts manager.

Mr. A. Chambers has been appointed by Siemens Edison Swan, Ltd., as its representative to the London radio wholesale trade for cathode ray tubes and valves. He takes over these responsibilities from **Mr. A. R. Grayson,** who will be continuing his contacts for other products of the company. Mr. Chambers, who has been with the company for twenty-four years, was until recently manager of the main distribution stores at Dalston.

Mr. C. V. Tonkin, planning and development engineer with the South Wales Electricity Board in its Eastern Area at Cwmbran, has retired after thirty-nine years' service in the electricity supply industry and on 22nd May, at the King's Head Hotel, Newport, a presentation dinner was held at which 170 colleagues, including Mr. J. S. Lombard, the Board's chief engineer, Mr. W. E. Richardson, West Wales area manager, Mr. A. C. Barratt, Mon. and Mid-Wales area engineer, and Mr. D. G. Gwyn, Mon. and Mid-Wales area manager, attended. The presentation was made by Mr. Gwyn. Mr. Tonkin was with the South Wales Electric Power Distribution Co. before vesting date.

Mr. C. V. Tonkin

Mr. H. D. Carter, chairman and managing director of Crossley Bros. and newly-elected president of the Institution of Mechanical Engineers, was one of the speakers at the parents' day of the **Metropolitan-Vickers Electrical Co., Ltd.,** on 30th May. Mr. Carter was one of some 300 visiting parents, whose sons and daughters, members of the College and School Section of the Metropolitan-Vickers Apprentice Association, acted as their guides on a short tour of the M-V Trafford Park Works. Others who attended were the Mayor of Stretford, Mr. H. H. Eckersall; Sir Willis Jackson, director of research and education, Metropolitan-Vickers; the Mayoress of Stretford; and Mr. R. F. Marshall, manager, Education Department, Metropolitan-Vickers. In addressing the parents, Sir Willis Jackson assured them that the future of the electrical industry was a very bright one and that there was wide scope within A.E.I. for their sons and daughters to play an important part in its continuing development.

At the annual meeting of the Association of Managerial Electrical Executive (electricity supply industry) **Mr. H. Marriott** was elected president for the ensuing year with **Mr. R. E. Wacher** as vice-president. **Mr. H. G. Penniket** was re-elected hon. treasurer.

Mr. R. W. Evans, B.Sc., B.A.(Econ.), A.M.I.E.E., has been appointed commercial officer of the Dumfries and Galloway Area of the South of Scotland Electricity Board. Since 1953 he has been district commercial engineer of the Ayr and Mauchline Districts. From 1949 to 1953 he was in the Commercial Department of the former South East Scotland Electricity Board.

Carron Company, Falkirk, celebrates its two-hundredth anniversary this year, and to mark the occasion it entertained 3,000 people to a banquet, which owing to its size was held in three parts, on 26th, 28th and 30th May. The guests were addressed by Mr. E. J. Leaver, manager of Carron Company, Senator A. W. Roebuck, Q.C., of Ottawa, Canada, who is a direct descendant of Dr. J. Roebuck, one of the founders of Carron Company, and Mr. C. H. Burder, M.B.E. (General Court of Carron Company).

Mr. J. C. Swales, a press setter at the Bedford works of Brookhirst Igranic, Ltd., was recently presented with the gold award of the National Blood Transfusion Service for having given fifty donations of blood.

OBITUARY

Mr. S. J. C. Wells, director and general manager of the South African company of George Ellison, Ltd., George Ellison S.A. (Pty.), Ltd., died at sea on 2nd June at the age of fifty-five. He was returning to South Africa after a visit to the United Kingdom.

The late Mr. S. J. C. Wells

Mr. Wells first came to England from South Africa at the age of ten and completed his education at Reading School. He was trained as an electrical engineer in this country, serving his apprenticeship with the British Thomson-Houston Co., Ltd., and later joining George Ellison, Ltd. He served the Ellison organisation for over thirty years in the United Kingdom and South Africa and represented George Ellison S.A. (Pty.), Ltd., on the B.E.A.M.A.

Sir Willis Jackson

Mr. G. S. C. Lucas

Mr. O. W. Humphreys

Prof. H. E. M. Barlow

Mr. C. O. Boyse

I.E.E. ELECTIONS

New President and Members of Council for 1959-60

THE Institution of Electrical Engineers has elected **Sir Willis Jackson,** D.Sc., D.Phil., Dr.Sc.Tech., M.I.Mech.E., F.Inst.P., F.R.S., director of research and education with the Metropolitan-Vickers Electrical Co., Ltd., as President for the year 1959-60.

Sir Willis has devoted the whole of his career to research and technical education. Born in 1904, he was educated at Manchester and Oxford Universities and served a college apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd. In 1926 he was appointed lecturer in electrical engineering at Bradford Technical College and, in 1930, took up a similar post at the Manchester College of Technology. Three years later he was appointed lecturer at Exeter and Queen's Colleges, Oxford. This was followed by two years (1936-38) with the Metropolitan-Vickers Electrical Co. as research engineer, after which he took up the appointment of Professor of Electrotechnics at Manchester University, a position which he held until 1946 when he became Professor of Electrical Engineering, Imperial College of Science and Technology, London. He was appointed director of research and education with Metropolitan-Vickers in 1953.

Sir Willis has served on a number of scientific and educational bodies, including the Scientific Advisory Council, Ministry of Supply (1948-54), University Grants Committee (since 1954), Radio Research Board, D.S.I.R. (1950-54), and the Royal Commission on the Civil Service (1953-54). He has also served on the Scientific Advisory Committee of the B.B.C. and the Central Advisory Council for Education in England. He was chairman of the Ministry of Education Committee on the Supply and Training of Technical Teachers for 1956-57, and has been a member of the Research Council of the D.S.I.R. since 1956.

Earlier this year he accepted an invitation from the Ministry of Scientific Research and Cultural Affairs of the Government of India to act as chairman of a committee, set up by the President of India, to review the work and progress of the first of the technological institutes in that country, the Indian Institute of Technology, Kharagpur. Sir Willis received his knighthood last year.

The new vice-presidents of the Institution are **Mr. G. S. C. Lucas,** O.B.E. (director and chief electrical engineer, British Thomson-Houston Co., Ltd.), and **Mr. O. W. Humphreys,** C.B.E., B.Sc., F.Inst.P. (director, Research Laboratories, General Electric Co., Ltd.).

To fill the vacancies on the Council which will occur on 30th September, the following have been elected:—*Members*: **Professor H. E. M. Barlow,** Ph.D., B.Sc.(Eng.), M.I.Mech.E. (Pender Professor of Electrical Engineering, University College, London), **Mr. C. O. Boyse,** B.Sc.(Eng.), M.I.C.E., M.I.Struct.E., Fel.Am.I.E.E. (managing director, Automatic Telephone & Electric Co., Ltd.), **Mr. L. Drucquer** (chairman, A.E.I. Divisional Management Co., Ltd., and divisional director and general manager, A.E.I. Heavy Plant Division), **Mr. H. G. Nelson,** M.A.(Cantab.), M.I.C.E., M.I.Mech.E. (managing director, English Electric Co., Ltd.), **Mr. J. R. Rylands,** M.Sc., M.I.Mech.E., F.Inst.F., J.P. (director and chief engineer, E. Green & Son, Ltd.), and **Mr. G. A. V. Sowter,** Ph.D., B.Sc.(Eng.)(manager (Metals Division), Telegraph Construction & Maintenance Co., Ltd.). *Associate Member*: **Mr. R. A. Hore,** M.A., B.Sc., D.I.C., Wh.Sc., A.M.I.Mech.E. (Merz & McLellan). **Mr. E. Leete** (director and consultant, London Electric Wire Co. & Smiths, Ltd.) has been re-elected hon. treasurer.

Electrical Industries Club

Col. B. H. Leeson, director of the British Electrical and Allied Manufacturers' Association, was the guest speaker at the luncheon meeting of the Electrical Industries Club on 9th June. In the absence of Mr. C. R. King (president), the chair was taken by Mr. E. G. Batt, vice-president.

Col. Leeson, whose talk was entitled "Whither the Industry—A Constant Vigil," said that the electrical manufacturing industry was one of the largest exporting industries in the country and the nation's prosperity virtually depended on it. In order to meet foreign competition a strong home market was essential.

Following the vote of thanks to the speaker, proposed by Mr. E. G. Batt, a presentation was made to Sir John Hacking, immediate past-president, in recognition of his services to the Club during his term of office. This took the form of a specially-bound book, by Sir John Glubb, a former guest speaker at the Club.

Mr. L. Drucquer

Mr. H. G. Nelson

Mr. J. R. Rylands

Mr. G. A. V. Sowter

Mr. E. Leete

Financial Section

STOCKS and SHARES

WHILE most of the firms which end their financial years with the calendar have now declared their dividends and results for 1958, the flow of company news is kept running by the many others which close their books at the end of March. For the electrical market the main point of interest in this category will be the General Electric Company's 1958-59 report. Last year the final dividend declaration and preliminary profits statement came in the middle of July. On that occasion the company announced a final dividend of 6½ per cent, making a total of 10 per cent, against 12½ per cent for the previous twelve months; last January the interim payment for the latest year was reduced from 3½ to 3 per cent. At that time shareholders were advised that high expenditure on research and development, particularly in the nuclear field, in combination with increases in wages and other costs, remained a heavy burden on profits, and that the full benefits of reorganisation had still to be felt.

July Dividends

Among other company news due within the next few weeks, the Ward & Goldstone results are awaited with much interest. With the 5s shares quoted at 46s 3d the yield on the basis of last year's 25 per cent payment is less than 2¼ per cent, indicating very confident hopes of good figures and perhaps another increase in the distribution: the 1957-58 payment was covered more than four times over by the profits available. Berry's Electric Magicoal 5s shares have also been in strong demand in advance of the 1958-59 figures. The price has risen during the course of this year from about 11s to nearer 20s, and here also a yield of only about 2½ per cent denotes optimistic expectations, based partly on an increase in the interim dividend during the year. Other announcements may be anticipated at about the same time from Dubilier Condenser, Hackbridge & Hewittic, Oldham & Sons, and Electrical Components.

Ever Ready Prospects

Annual results published by Ever Ready (Great Britain) last month had one of the best market receptions of the year, the price of the 5s shares rising subsequently from about 28s to over 40s. They were satisfactorily maintained at around 38s ex-dividend after the appearance of the full report, in which the chairman, Mr. E. N. Rowbotham, gave an encouraging account of further prospects. He ascribed the record figures for last year (the sixth in succession to show increased sales and profits) to progress on practically all sides of the business, especially in export markets. In the year now running, he described sales in the domestic market as buoyant and anticipated with confidence—subject to the usual reservations—the maintenance of a large and expanding business overseas. A special interim of 7½ per cent is being added to the 20 per cent dividend. On the total of 27½ per cent the yield on the shares works out at a little under 3¾ per cent.

Ether Issue

Recently introduced to the market, the 5s shares of Ether, Ltd., manufacturers of measurement and control instruments, thermostats, voltage regulators, etc., have been quoted at 14s and will be transferable free of stamp duty until the first week in July. Particulars published in connection with the issue showed a steadily upward trend in profits over the past ten years, the latest figure being £126,000 for the twelve months ended last September. Earnings in the first half of the current year will have been affected by expenses and rearrangements involved in transferring production to a new factory, but the directors expect a marked improvement in turnover in the second half, by the end of which profits should be running at an annual rate above that of 1958. Their intention is to pay an interim dividend of 5 per cent in September and a final, to make a total of 15 per cent, next March. At that rate the yield on the shares will be just on 5½ per cent. Issued ordinary capital is £250,000.

Walsall Conduits Results

Walsall Conduits 4s shares were quoted at 22s shortly after the declaration of the final dividend for 1958 and the proposal of a three-for-four scrip issue. The payment maintains the rate at the total of 22½ per cent to which it was raised a year ago. According to the preliminary statement, group profits contracted by 7 per cent, but after a smaller tax charge the net surplus came out slightly higher than before at £341,000, which appears to cover fully three times over the net amount to be distributed in the ordinary dividend. A three-for-one scrip issue was made four years ago, since when the reserves have again been built up to a figure well in excess of the present ordinary capital of £800,000. They totalled more than a million in last year's balance sheet, so that the capitalisation of £600,000 through the proposed scrip distribution will still leave a substantial balance.

Kango Electric Progress

Introduced to the Stock Exchange last autumn at a price of a little under 5s, the 4s shares of Kango Electric Hammers have been quoted lately at about 8s, offering a yield of 6¼ per cent on the basis of the 1958 dividend, which was equivalent to a total of 12½ per cent on the present capital of £180,000. Profits in 1958 came out above the prospectus estimate at £63,000 before tax, and provided more than twofold cover for the dividend distribution. An encouraging account of prospects was given by the chairman at last month's annual meeting. Rising demand for the products had resulted in a 20 per cent increase in sales during the first four months of this year, as compared with the same period of 1958; the order book for the first quarter was larger than for the same period of any previous year; and the expansion of building programmes offered every prospect that the upsurge in demand would continue throughout the year.

Wolf Electric Tools

Difficult trading conditions in home and export markets continued throughout last year to affect the earnings of Wolf Electric Tools. By the introduction of new products and by more intense publicity the decline was kept within moderate limits, but profit margins suffered and the result was a net profit of about three-quarters the previous year's figure. There was no difficulty, however, in maintaining the dividend at the rate of 10 per cent (or its equivalent) paid for the four preceding years; it is covered more than twice over by the latest earnings. In the first quarter of the current year the chairman reported some improvement, which he thought could be at least maintained. At 8s the 5s shares offer a 6¼ per cent yield.

W. H. Allen Dividend

The £1 shares of W. H. Allen, Sons & Co. reacted well to the company's announcement of increased earnings and of dividend distributions making, in effect, a total of 12 per cent; this is a point above last year's and includes 3 per cent in the now familiar form of an interim on account of the current year, presumably for profits tax reasons. After being marked up to 49s, the shares show a yield of approximately 5 per cent on the new rate of dividend. This remains well inside the conservative category, for without taking into account special deductions the net amount of the distribution will absorb barely a quarter of the surplus available, after tax. Trading profits expanded from under £900,000 to a little over a million.

Westool Sales Conference

A sales conference on "Westair" air conditioning equipment was held at the works of Westool, Ltd., St. Helen's Auckland, Co. Durham, on 28th and 29th May, and was attended by agents and distributors from all over the British Isles.

REPORTS and DIVIDENDS

The Chloride Electrical Storage Co., Ltd.—The annual meeting was held on 3rd June, Mr. A. W. Browne (chairman and managing director) presiding. In his statement, which had been previously circulated, the chairman said that competition was intensifying particularly in the markets for automotive batteries and for batteries for electric factory trucks. It was satisfactory that their principal business was in such an expanding market, but in some countries in which they were operating it was clear that the battery-producing capacity was in excess of the foreseeable demand. It was probable that those manufacturers who were not well equipped and efficient would find themselves in difficulties.

They were meeting the challenge in two ways. First, they continued to devote much of their effort and financial resources to technical research and development. The new research laboratories were nearing completion and would be in full use within the next few months. In addition to these highly competitive battery markets, there was an important demand for many other types of batteries for hundreds of different applications. In many of these the degree of technical skill and "know how" required was of a high order. Though the volume was less, a satisfactory contribution was made to their economy by the production of these more specialised types. The second answer to the challenge was by concentration and the streamlining of their manufacturing, selling and service facilities. Last year he mentioned certain rationalisation schemes that were taking place in this country. These were now nearing completion and it was clear that the expected benefits to their economy would be forthcoming. A similar process was now taking place in their organisations in Australia and India. Mr. Browne concluded his statement with brief references to the company's other interests.

The Ever Ready Co. (Great Britain), Ltd.—The annual meeting will be held on 1st July. In his circulated review of the past year, Mr. E. N. Rowbotham (chairman) says that for the sixth year in succession he is able to report an increase in the sales and net profits of the company. The record profit has been achieved by reason of substantial progress in practically all departments of the business, particularly in the export field where they have been successful in obtaining an exceptional increase in turnover.

In the domestic market sales have been buoyant. A recent innovation has been the introduction of a new product—the "Figaro" electric dry shaver, which has been well received. Overseas, subject to no major political or economic upheavals, they view the continuance of a large and expanding export business with confidence. Trading for the current year has been satisfactory, sales to date being in excess of those for the similar period of last year.

Ferranti, Ltd.—The preliminary statement for the year ended 31st March last shows a group profit of £1,104,572, as compared with £575,971 for 1957-58. This is struck after taking into account a net loss of £29,157 sustained by subsidiary companies and after providing £1,310,000 for taxation. It is proposed to place £950,000 to general reserve and to pay an ordinary dividend for the year of 6 per cent (unchanged) on doubled capital as increased by a one-for-one scrip issue in July last year. The consolidated balance carried forward is £297,142, against £313,701 brought in.

Walsall Conduits, Ltd. — The preliminary statement for 1958 shows a group profit of £662,461, as compared with £712,122 for 1957, but after lower taxation of £321,750, the net profit is £340,711 (against £337,278). Revenue reserve receives £40,000 and it is proposed to pay a final dividend of 15 per cent, maintaining the distribution for the year at 22½ per cent. It is also proposed to capitalise £600,000 of reserves in a three-for-four scrip issue.

W. H. Allen, Sons & Co., Ltd., report profits for 1958 of £1,038,769, as compared with £892,860 for 1957. After deducting £525,000 for taxation, the net balance is £513,769 (against £445,860). General reserve receives £295,000 and reserve for increased costs of replacement of fixed assets £61,091. It is proposed to pay a final dividend of 6½ per cent for 1958 and a special 3 per cent interim dividend in respect of the current year, making a total for the year of 12 per cent (against 11 per cent).

New Companies

J. S. Row, Ltd.—Registered 1st May. Capital £4,000. To acquire the business of an electrical installation contractor carried on by J. S. Row at Rayleigh. Directors: J. S. Row (chairman) and Mrs. Esther E. Row. Regd. office: 315, Eastwood Road, Rayleigh, Essex.

Bindons (Electrical), Ltd.—Registered 2nd April. Capital £100. Electrical equipment specialists, manufacturers of and dealers in batteries, accumulators, etc. Directors: H. Armstrong, R. G. Bindon Howell and H. H. Goodman. Regd. office: 34/8, Pevensey Road, Eastbourne.

Birch Evans & Jellings, Ltd.—Registered 14th April. Capital £5,000. To acquire the businesses of Birch & Evans and Jellings & Co., carried on by W. H. Jellings at 242, Stafford Street, Walsall, and at 25, Highgate Road, Walsall, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in radio and television receivers, etc. Directors: W. H. Jellings and Mrs. Gwendoline D. Jellings. Regd. office: 242, Stafford Street, Walsall.

Knight-Clarke, Ltd.—Registered 17th April. Capital £100. To acquire all the goodwill, equipment and stock in trade of the business carried on by C. E. Knight-Clarke at 23, Radnor Mews, W.2, under his own name and as Specialist Switches; to carry on the business of manufacturers of and dealers in components and equipment relating to the electronics and/or electrical industry, etc. Directors: C. E. Knight-Clarke and Mrs. Patricia A. Knight-Clarke. Regd. office: 97 and 99, Park Street, W.1.

Tooley Electro Mechanical Co., Ltd.—Registered 3rd April. Capital £5,000. Manufacturers of and dealers in generating and pumping plant and generating, pumping, heating, lighting and ventilating appliances, etc. Directors: T. B. Price and Marie A. Price. Solicitors: Freer Bouskell & Co., Leicester.

Bolding & Rudder, Ltd.—Registered 17th April. Capital £100. Electrical and mechanical engineers, etc. Directors: A. L. Rudder, Doris Rudder, F. E. Bolding and Vera M. Bolding. Regd. office: 50a, Goodrich Road, London, S.E.22.

E. A. Byfield, Ltd.—Registered 23rd March. Capital £1,000. Electrical engineers, etc. E. A. Byfield is the first director. Regd. office: 23a, Vale Street, Upper Gornal, Dudley.

Rev Electrotors, Ltd.—Registered 20th April. Capital £100. Manufacturers of and dealers in radio, electrical and mechanical apparatus of all kinds, etc. Directors: R. H. Hatfield and S. G. Sitton. Regd. office: Crawley Road, Horsham.

Liquidations

Electronic Distributors, Ltd., and **Electronic Distributors (Exeter), Ltd.,** wholesalers in radio and television parts, registered office, 61, Carey Street, Lincoln's Inn, London, W.C.2.—Winding up voluntarily. Liquidator, Mr. N. K. Ramsay, 61, Carey Street, W.C.2, appointed 26th May.

Refrigerator and Electric Appliance, Ltd., 2, Grasmere Road, Blackpool.—Liquidator, Mr. E. Rawcliffe, 23, King Street, Blackpool, appointed by creditors on 29th May.

Bankruptcies

A. E. Shaw, 31, Bowden Road, Parkstone, Poole, Dorset, electrician.—Public examination 16th September at the Law Courts, Stafford Road, Bournemouth.

W. H. Lawrence, 30, Radlett Road, Frogmore, near St. Albans, Herts., electrician, lately carrying on business in the name of Home Maintenance (Electrical) Service at 342, St. Albans Road, Watford, formerly in partnership with others, but now on his own account.—Trustee, Mr. R. A. Hawken, Bank Chambers, 1, John Street, London, W.C.1, appointed 1st June.

Edwards Electrical & Radio, 384, Finchley Road, London, N.W.2, electrical engineers.—Receiving order made 2nd June on a creditor's petition.

K. R. Clover, trading as K. R. Clover & Co., at 3, Market Cross, Sturminster Newton, Dorset, radio and electrical engineer.—Application for discharge to be heard on 10th July at the Crown Court, New County Hall, Dorchester.

G. H. Collins, lately carrying on business at Astoria Buildings, Brighouse, Yorks., electrical engineer.—First dividend of 6s 3d in the £, payable at the Official Receiver's Office, 20, North Parade, Bradford, 1.

N. D. Keene, trading as N. & D. Keene, at 78, Llewellyn Street, Pontygwaith, Glam., radio, television and electrical contractor.—First and final dividend of 8s 4d in the £, payable at the Official Receiver's Office, County Court Buildings (First Floor), Westgate Street, Cardiff.

W. R. V. Salt, 232, Archway Road, Highgate, London, N.6, radio, television and electrical engineer.—First and final dividend of 6s 1 7/16d in the £, payable on and after 22nd June at Bankruptcy Buildings, Carey Street, London, W.C.2.

British Electrical Power Convention

We give below reports of the annual dinner and Electrical Forum at the Torquay Convention which circumstances prevented us from including in last week's issue

THE annual dinner of the Convention was held at the Palace Hotel, Torquay, on 4th June, with the President (Mr. C. R. King) in the chair. The principal guest was the Rt. Hon. Philip Noel-Baker, P.C., M.P., a former Minister of Fuel and Power, who, in proposing the toast of "The Electrical Industry," said that he did so with great enthusiasm, with some happy personal memories and with high hopes for the electrical industry and for the world, the prosperity of which depended so much on the electrical industry. Paying a tribute to the President, he described Mr. King as a kind of moral Midas, who from everything he touched obtained a golden result.

The electricity industry had a marvellous record and had over the last eleven years made matchless progress in efficiency, in development and in service to the consumer, who in real terms was paying less for his electricity than he had paid before the war. These astonishing results had been achieved in the face of great difficulties

Electricity, however, was not the answer to every problem, and the improvement in the load factor, though no doubt a great achievement, was not enough and did not compare with what had been achieved in some other countries. He did not believe that electric cooking was the answer, or that the electric cooker was better than the gas cooker. One answer was the staggering of hours in industry, another was better street lighting, which would do much to reduce death on the roads, and another was the electrification of the railways, which was proceeding far too slowly. The problem of city transport should also be tackled. The noise and fumes of petrol vehicles constituted a grave social problem, but electric vehicles were not yet so efficient as they ought to be.

He found it difficult to believe that the electrical industry was spending enough on research, and it was disconcerting to find no mention of research on the storage battery, which had not changed much since the days of Faraday; its inefficiency was hindering the development of the electric vehicle industry. If the Electricity Council would vote £10 million to be spent over the next five years on research on the storage battery it would be of great value to the people of this country and to our export trade.

The President, who responded, said that there were no comparable figures against which to measure the present achievement so far as load factor was concerned. Before the war it had been impossible to arrive at an accurate figure, and after the war load shedding, by taking away the tip of the peak, had artificially improved the load factor. The present figure was 46-47 per cent, and he was certain that it would improve, and that the Area Board chairmen would see that it did; there was not much that the Generating Board could do about it.

It was probably true that over the last eleven years the industry had not spent enough on research and development, having been too busy doing so on other things, but plans for the development of research were being made. The Electricity Council and the Central Electricity Generating Board were to build a new laboratory at Leatherhead at a cost of over £1,000,000, and there was to be a research laboratory at Berkeley nuclear power station. He hesitated to say anything about the money that the consortia were spending on research and development. It was to be hoped that they would get their money back, but it would not be yet awhile.

He was a firm believer in the Convention not merely for the knowledge which could be gained by attending the meetings but because of the opportunity it gave to meet people with whom one might be in correspondence but never met in the ordinary way. If for no other reason these annual gatherings of manufacturers, contractors, consultants and the supply side were well worth while, and he hoped that the Conventions would continue.

The toast of "Our Guests and Ladies" was proposed by Sir John Pickles and responded to by the Mayor of Torquay, Alderman Haarer.

Electrical Forum

The customary Electrical Forum was held on the last day of the Convention, the panel consisting of Sir Henry Self, Sir Christopher Hinton, Mr. H. G. Nelson and Mr. W. S. Lewis, with the President as "question master."

The first question recalled the suggestion of the Herbert Committee that the supply industry should urgently review the conditions which were causing well qualified men to leave it, and asked whether steps had been taken

Mr. C. R. King presides at the Electrical Forum. The panel consists of Sir Henry Self, Mr. H. G. Nelson, Sir Christopher Hinton and Mr. W. S. Lewis

Sir John Pickles invests Mr. King with the past-president's badge

to reverse this trend. Sir Henry Self said he did not regard all the statements of the Herbert Committee as the last word on the subject. It was true that the supply industry had lost outstanding men, but it had lost them to another branch of the electrical industry, and this meant an exchange of experience which was good for all concerned. Until recently salary conditions in the supply industry had not matched the responsibilities and work involved, but that had been adjusted and what was generally regarded as a fair salary structure had been obtained. Discussions were going on in the Joint Advisory Committee for a comprehensive survey of the principles which should regulate the training and promotion of men of ability at all levels, and provision had now been made for senior officers to become part-time members of their Boards.

Mr. Nelson said that if there had been a flow from the supply industry into the manufacturing industry there had also been a steady and larger flow in the reverse direction, and this was to be welcomed. The supply industry had handled the situation extremely well, and the manufacturing industry would have to take note of the attractions which they now offered.

Sir Christopher Hinton doubted whether the supply industry was keeping pace with outside industries in competing for the limited number of technically qualified men available, but felt that the new scholarship scheme would in time help to rectify this situation. Mr. Lewis maintained that whatever its level of salaries the supply industry would lose some people to other industries. He saw no objection to this and hoped the time would never come when it would operate in a watertight compartment.

Oil and Coal

The next question was whether the economics of oil burning were such that large quantities of imported oil should continue to be burned at power stations even if this accentuated unemployment in the coalfields. Sir Christopher Hinton replied that at present the C.E.G.B. had firm contracts for the supply of oil which it would be difficult to change, and generated electricity at stations using oil a little more cheaply than at stations using coal. This country was passing from a one-fuel to a three-fuel economy, and it would be a long time before a proper balance in that three-fuel economy was evolved, but his guess would be that the burning of oil in central power stations would not increase materially, because the large generating station provided the least attractive way of using oil as a fuel.

Sir Henry Self pointed out that fuel policy involved national issues which had to be decided by the Government. If the supply industry had to modify the policy which it would pursue on economic and operational considerations in order to conform to national policy, this should be made clear to the public.

Mr. Nelson emphasised that if British industry was to compete in world markets it must have the cheapest power it could get. We were moving into an atmosphere of free competition to get prices down, and this should apply also to fuel. Coal must stand on its own feet; but, as it was of essential importance to use indigenous fuel, everything possible should be done to ensure that coal was competitive with oil.

Price Agreements

Replying to the question of whether the ending of price agreements would be in the long-term interest of the electrical industry as a whole, Mr. Nelson recalled the plight of the manufacturing industry before the time, in the middle 'thirties, when order had been restored by a system of price agreements to eliminate cut-throat competition. From that time the manufacturing industry and the supply industry had gone from strength to strength. That under this system the manufacturing industry had been efficient was proved by the export figures, selling in a free market; that it had been resourceful was shown by its ability to cope with the war situation and subsequent rehabilitation; and that it was technically well equipped was demonstrated by the remarkable technical progress in recent years. The system had enabled the industry to be a pioneer in providing good conditions of employment for its workpeople and to lead the world in this respect. It had been able to attract the capital to fulfil its task, and the record showed that its earnings had not been unreasonable. What was wrong with a system which had led to such results? A return to the law of the jungle would give the strongest the greatest amount of power and so lead to monopoly, the very thing that unregulated price arrangements were supposed to avoid.

Sir Christopher Hinton said that the electrical manufacturing industry was in a difficult position at the present time, because with the increase in the size of plant the number of orders was falling precipitately. He would deplore a return to cut-throat competition, which would lead to cuts in the allocation to research and development which would be fatal in the long run. He did feel, however, that the quoting of identical prices was absurd and irritating.

Mr. Lewis said he was in favour of price agreements and objected to blacklegs in any walk of life. It did not follow that price agreements entailed paying more; sometimes they led to getting things more cheaply. Price cutting was reflected in the class of material supplied and in the old days had affected the wages and conditions of the workers. In the main the price agreements in the electrical industry had been in the interests of both the supply authorities and the manufacturers.

Sir Henry Self said that no one wanted price warfare or the loss of efficiency which price-cutting entailed, but the public would not be satisfied with a system of price agreements unless there was a measure of profit sharing and some specific price basis which ensured maximum efficiency and maximum economy in manufacture.

Mr. Nelson, replying to Sir Henry, pointed out that the supply industry shared in the profits of the manufacturing industry through the large amount spent by the latter on research from which the supply industry would profit for many years to come.

Standardisation of Tariffs

The next question dealt with future progress towards more uniform retail tariffs and the possibility eventually of uniform tariffs throughout the country. Mr. Lewis said that there could never be standard tariffs so long as there were differences in the coal charges to Area

Boards. He favoured standard coal charges throughout the country. There were other differences between Area Board conditions which would make standard retail tariffs extremely difficult without a national subsidy in certain directions.

Sir Henry Self thought that the granting of autonomy to the Area Boards was a recognition of the fact that the differing conditions in different areas must be reflected in differing tariffs. There was now a considerable measure of uniformity in the structure of tariffs, but the content of the tariff must vary with the area. The supply industry had no monopoly and firms could do their own generation if the price offered them was not competitive.

Sir Christopher Hinton added that the variation in the bulk tariff in the various areas would in time diminish as nuclear generation increased, because the fuel charges would be uniform. In his view the present incidence of coal charges was correct, but he knew that Mr. King took a different view.

The President said there were many industries close to nuclear stations, and he wondered how long the industrialists concerned would be content to know that while the current came from a nuclear station they were paying an increased cost based on so much a ton of coal. The agreement referred to coal, oil or other fuel, but he did not believe that it was possible to equate the heat value obtained from reactors with that obtained from coal. He was strongly in favour of an advance towards uniform tariffs throughout the country.

Power and Amenities

How the obligation to have regard to the amenities of the countryside could be reconciled with the provision of an efficient and economic supply of electricity was the subject of the next question. Sir Henry Self suggested that the provision of a service might often involve some loss of amenity, but if power was wanted a price had to be paid for it, and the question was how much. The North of Scotland Board had done much to enhance amenities in its area, and in 25 years' time many power stations would come to be looked on as venerated landmarks.

Mr. Nelson thought that more use could be made of landscaping, the techniques of which in industry had been used with great benefit and without much expense. Sir Christopher Hinton regarded the preservation of amenity as the biggest problem facing the Generating Board, and one to which he could not see the solution. He agreed with Mr. Nelson on the value of landscaping, but the difficulty was not that a transmission tower was ugly—it was not—but that no one wanted to see it, or any other overpowering man-made structure, in rural areas to which they went for rest and recreation. The use of 500 kV transmission would do something to ameliorate the problem.

Nuclear Power Programme

Sir Christopher Hinton then dealt with the question of whether the present programme of nuclear stations was likely to be followed by a second programme and said he had absolutely no doubt that it would be, though he did not know on what scale. The estimated cost of power from the nuclear stations which were being built today was about 0·7d/kWh, while the estimated cost from conventional stations which were being built in the cheap coal areas (which seemed to be the correct comparison, since the nuclear stations were to operate on base load) was about 0·52d/kWh, but the cost of nuclear power was coming down and would continue to do so. Three years ago he had made a forecast of the way in which the cost of nuclear power was likely to come down, and he thought that that still stood, but the comparison which he had then made with the cost of conventional power was wrong, because there had been a precipitate drop in the capital cost of conventional stations and a rise in their efficiency. He had also assumed that the cost of coal would rise in real terms but it was now very doubtful whether that would happen. The easing of the coal market, the mechanisation of mining and the closure of uneconomic pits might lead the Coal Board to reconsider its price structure. He had put the "break-even" date for nuclear and conventional power costs at 1965, but he now guessed that it would be 1970.

Mr. Nelson drew attention to the feeling of uneasiness in the industry which was dealing with atomic power. The active development programme necessary to ensure the achievements which Sir Christopher had in mind cost a great deal of money and involved the use of large teams, and there was great anxiety about whether the large sums invested by industry would be recovered.

Other questions dealt with stoppages of work on nuclear power stations, which Mr. Nelson thought were greatly exaggerated in the Press and did this country harm abroad, and with the economics of very large generating sets, in connection with which Sir Henry Self paid a tribute to the courage of the engineers, and in particular Sir John Hacking and Sir Josiah Eccles, in going ahead with these large sets with a full knowledge of the risks involved. A question on load factor led Sir Christopher Hinton to remark that the Generating Board was already providing, in effect, a special night tariff, because any additional units taken at night were charged by the Board at their marginal cost of production, and to go lower than that marginal cost, which did not include capital charges, would be incorrect from a business point of view.

Annual Meeting

The report for 1958-59 presented at the annual meeting held on 5th June contained a summary of the proceedings at the 1958 Brighton Convention and accounts recording a balance of income over expenditure. It also included graphs showing the number of delegates at the past ten Conventions, the number of copies of papers circulated, the income and the expenditure.

Lists of the Council and committees were included. The Management Committee consisted of the President and Vice-president, Sir George Nelson and Messrs. W. N. C. Clinch, W. J. Jones, D. H. Kendon, B. H. Leeson, C. T. Melling and A. M. F. Palmer, M.P. The members of the Papers Committee were the President and Vice-president, Sir George Nelson, and Messrs. J. I. Bernard, D. B. Irving, B. H. Leeson, W. J. Jones, K. J. McKillop and A. M. F. Palmer. The Exhibition Committee members were Messrs. Lewis Hart, Ivor Williams, H. P. Sale, A. Mackenzie Parkinson, K. R. Taylor, A. E. Prophet, T. Counter, W. N. C. Clinch, J. I. Bernard, D. F. Hall, F. B. Berry, C. J. George and W. J. Guscott (co-opted).

As we reported last week, the election of Lord Chandos, chairman, Associated Electrical Industries, Ltd., as the next President of the Convention was announced, with Sir John Pickles, chairman, South of Scotland Electricity Board, as Vice-president.

Iron and Steel Institute

The Iron and Steel Institute is holding a special meeting on the North-east Coast from 6th to 10th July. The programme will include a number of works visits and evening social functions have been arranged for members and their ladies.

Electro-Heat Congress

REPORT OF WORKING SESSIONS

Some 500 delegates from seventeen countries attended the Fourth International Congress on Electro-Heat held recently at Stresa, Italy, the opening proceedings of which were reported in our last issue. The papers presented were arranged in ten subject groups. The main points discussed are summarised below

THE Working Sessions were opened by Mr. C. T. Melling, chairman of the British National Committee on Electro-heat in his capacity as chairman of *Section I*. This Section dealt with the reports concerned in a general way, or on the basis of statistics, with the economics of electro-heat in relation to energy supply in general and electricity supply in particular, and their bearing on productivity and on conditions of work. The report in this Section showed that whilst only a relatively small part of the total heat requirements of industry is obtained by conversion from electricity, the importance of this part as regards its effects on productivity by far exceeds its relative magnitude; it has, in fact, become an indispensable concomitant of the success of the industrial development of any country. The improvement of productivity through the use of electric welding, melting of metals, etc., was referred to in more detail and one paper in particular dealt with the promotion of electro-heat by electrical plant manufacturers, and by electricity supply undertakings whose main interest lies in the possible improvement of their system load factors through an increased use of electric heating process. These aspects were also touched upon in other Sections. Several papers in this Section dealt with the position of natural gas compared with electro-heat in various European countries and others with the position of electro-heat in the economy of Italy, Japan and Switzerland respectively, where water power accounts for a large proportion of the electricity generated. The report on Japan contained a statistical analysis of the industrial electro-heat equipment installed in that country, and another paper presented a similar statistical survey for France.

Several reports in this as well as in other Sections stressed the importance of electricity supply tariffs in fostering the development of electro-heat, and one report gave an account of measures taken in various countries to promote the knowledge of the economic and technical potentialities of this form of heat production. As the International Electro-heat Union is debarred by statute from dealing with tariff questions in detail, a resolution was passed calling for the establishment of close liaison in this field with the International Union of Electricity Producers and Distributors (UNIPEDE).

Mr. J. I. Bernard (E.D.A.) and Mr. G. W. Richards (South Western Electricity Board) and Mrs. Richards

Arc Furnaces

In *Section II* over twenty papers were submitted on various aspects of iron and steel melting, and in particular on melting by arc furnaces. The discussion produced lively arguments on the relative merits of motor driven and hydraulic control mechanisms and drew attention to a paper by an American author which referred to hollow electrodes and their advantages in reducing voltage fluctuations and allowing higher loading. Other papers also dealt with furnace construction and more specifically with electrodes.

One author advocated the reduction of ores in a combination of non-electric and electric furnaces, the latter being employed for the last stages, claiming both technical and economic advantages for this arrangement. A reducing furnace for use with raw materials in granular or powdery form was described which has a "fluidised bed" of carbon powder through which the electric current is made to pass by means of immersed electrodes. Inductive stirring in arc furnaces was the subject of another paper and discussed on several occasions.

Papers and discussions showed that arc furnaces have passed the stage in their development where the engineering design poses the most acute problems, and that they have moved into the stage where the main emphasis must be placed on basic research into arc phenomena. Further contributions to this subject were made in other sections, and in particular in *Section X*. A weakness of the papers and the discussion in this Section was the dearth of contributions from the users of arc furnaces, in particular the steel industry, where individual firms appear to be reluctant to part with their experience and in consequence also restrict the publication of relevant information by their plant suppliers. The hope was repeatedly expressed that the position might change before the next Congress is held in 1963.

Section III dealt with the use of electric heating in iron and non-ferrous metal foundries. With three out of a total of 17 papers in this section by British authors British interests were well represented, discussion being mostly lively on a British paper dealing with vacuum induction furnaces of up to 3,000 lb capacity. A paper by Russian authors referred amongst others to the construc-

Mr. E. M. Ackery (E.D.A.), Mrs. Caddell, Mrs. H. J. Gibson, Mr. S. Scholefield (Midlands Electricity Board) and Mr. H. A. P. Caddell (Midlands Electricity Board)

tion of an electric vacuum melting furnace with an inductor suitable for operation at voltages up to 2,000 V and the use of graphite heaters and graphite thermal insulation for high temperature electric vacuum furnaces. A paper by an Austrian author dealt specifically with the cost of the electric melting of non-ferrous metals, taking into account amongst other factors also the loss of metal in various types of furnaces.

The contributions to *Section IV*, on electro-heat in the mechanical engineering industries, could be roughly divided into two groups, one dealing with resistance heating and the other with induction heating. Whilst some of the papers in the first group were of considerable technical interest, few, if any, dealt adequately with the economic aspects of the subject. One of the British papers treated developments in resistor heated vacuum furnaces and a Russian paper gave a survey of the present state and main trends of development of high frequency electric heating processes in the U.S.S.R. An Italian paper discussed the economic advantages of combining induction with radiant heating in the forming of steel and described a novel method for the rapid heating of small metal bars. Five papers reported in detail on research on refractory steels carried out under the auspices of the French Electro-heat Committee. German authors dealt amongst other subjects with direct resistance heating of billets in rolling mills and a rolling mill installation employing mixed gas-electric heating, apparently with economic success.

Other papers dealt with a great variety of electro-heat applications mainly in the steel industries, and in the discussion complaints were voiced also in this Section about the alleged secretiveness of the steel-makers in respect of technical and economic operating experience. It also showed that the advantages held by electric heating over gas and other sources of heat are gradually receding due to the recent development of improved process control for these sources of heat, and that combined heating, employing electricity only where close controls are needed, is gaining in popularity due to claimed economic advantages.

Glass and Ceramics

The reports in *Section V* on glass and ceramics, on the Committee of which Great Britain was represented by Mr. H. J. Gibson, were interesting from the technical as well as the economic viewpoints. One of the two British papers in this Section described a furnace for the melting of glass by the passage of an electric current through the glass itself; the furnace design was said to have overcome certain difficulties inherent in the earlier application of this method of melting. Another British report on electricity in the pottery industry appeared to be of much interest, judging by the discussion it provoked. A paper by a German author described, *inter alia*, a continuous ceramic furnace with controlled atmosphere which provides for charging and discharging through a gas lock of interesting design.

Plastics and other Materials

The Committee directing the work of *Section VI* on plastics, wood, textiles, rubber and leather was under British chairmanship (Mr. M. O'C. Horgan), and both the general reporter (Mr. J. I. Bernard) and the secretary (Mr. E. M. Ackery) were also British. Lively discussions arose in particular on the subject of high-frequency and infra-red drying of wood, and more especially on the economics of this system, and on the humidity limits within which it is of advantage. Regrettably, the author of two controversial papers was not present to substantiate his views. The difficulties encountered in the vulcanising of rubber, largely due to the inhomogeneity of the material, were dealt with at length and a paper by two Japanese authors developed the interesting theory that, for the design of radio-frequency dryers, the critical power density in the material at which "internal explosion" may occur should be considered as a fundamental factor. Reference was also made to research work carried out in Germany on drying by a repetition of short heat impulses which showed great promise of reducing the cost of electric drying processes and was discussed in more detail in Section X. The discussion on a British paper on electrode boilers for industrial heating pointed to the possibility of fluids other than water being adopted for such boilers to avoid high pressures in high temperature installations; the difficulty here apparently arose in the choice of a suitable fluid and the likely cost would probably only justify this system in special cases.

In respect of plastics, frequencies of up to 20 Mc/s for welding of small components are used, but at these frequencies radio interference becomes a serious problem. For larger parts, there is a tendency for lower frequencies to be used. Infra-red drying is widely applied and here the tendency appears to be turning in favour of sheathed heater elements. Steam boilers are gaining in popularity for special applications where they can be situated either on or near existing machines requiring steam supplies, thus saving in capital costs, and heating up and operating time, or for boosting the temperature of an existing fuel

Left to right: Mr. D. B. Irving (London Electricity Board), Mrs. Clinch, Mrs. Irving and Mr. W. N. C. Clinch (Central Electricity Generating Board)

heated hot water system at particular points in the system where or, at particular times, when a higher temperature is required.

The wide range of the subjects included in *Section VII* (foodstuffs, chemical and pharmaceutical products) was reflected in the diversity of the submitted reports which for convenience were grouped under three technical headings. Amongst the reports in the first group, on the application of infra-red heating, was one by an Italian author on the drying of green fodder which gave an account of the results achieved in this field by the National Centre for Agricultural Mechanisation in Turin and another Italian paper on the infra-red drying of rice and the economics of this process. Two papers by a French author dealt with the drying of paint, and the infra-red baking of biscuits, the drying of cacao beans and other products, and described some of the technical and economic advantages of this method.

Dielectric Heating

The second group dealt with dielectric heating and amongst the more important papers was one by Belgian authors on the pasteurisation of milk by high frequency and mains frequency currents; an interesting and simple arrangement for direct sterilisation by mains supplies was described. Another paper described a high frequency baking oven where the baking process takes only 12 minutes, although subsequent convection baking of 10 minutes is required to produce an adequate crust. The use of activated yeast reduced the fermentation of the dough to 25 minutes. A paper by a Japanese author described a novel non-destructive method of extracting natural camphor from timber using a combination of radio frequency and steam drying; the author recommends a continuous measurement of the moisture content of the timber during the drying process by a capacitive method to enable the process to be controlled economically. Another Japanese report described an electric pig-iron furnace where the furnace gas is extracted and used in the manufacture of chemicals.

The third group of papers, on resistance heating, contained amongst other reports a paper by a British author on electric surface heating by means of resistance pads, and one by an Austrian author on electric storage bread baking ovens of which there are a considerable number installed in Austria. The discussions on the above-mentioned and the remaining reports in this Section showed the desire of the delegates for a closer co-operation with specialists in electro-chemistry and for a larger number of papers from the heavy chemical industry to be presented at the next Congress.

Section VIII dealt with a number of reports on the manufacture of calcium carbide, aluminium, magnesium, ferrous alloys and similar products. A paper by an Italian author described hollow electrodes of 3·2 m diameter, for use in single-phase furnaces; lime and coke are charged, and CO_2 extracted, through the electrode and the furnace can remain continuously uncovered. There were interesting reports by Yugoslav, Japanese and other authors and a Polish report dealt with the effects, technical and economic, of calcium carbide and graphitisation furnaces on electricity supply systems. A report by a German author described a novel magnesium furnace where the metal is heated exclusively by radiation, and in which the internal pressure can be easily regulated and maintained above or below the atmospheric.

In his summing up of the work of this Section the chairman remarked upon the progress made in recent years in the field of reduction furnaces, but considered that in many countries the electricity supply industries were not sufficiently alive to the value of electric furnaces as a load and that electricity might be applied more extensively for preheating and pre-reduction purposes if suitable tariffs were available.

The reports in *Section IX* dealing mainly with electricity supply problems could be grouped under four headings: single-phase loads and interference of arc furnaces on mains supplies; utilisation of off-peak and surplus supplies; tariffs, economic data and statistics; and sales and sales promotion. Economic considerations were in the foreground of all the papers and the discussions.

In the first group, a paper by a British author took a steelworks with one 15 MW and one 20 MW arc furnaces as a practical example to discuss the technical and economic problems associated with such loads, the precautions to be taken in the future in view of the increasing size of arc furnaces so as to avoid excessive load and voltage fluctuations, and tariffs to be suitably applied. Two reports on the same theme, one by an Italian author and one by a Belgian, came to practically the same conclusions as regards the measures to be taken to avoid disturbance by heavy fluctuating loads. However, all three reports showed up the need for further work on a number of questions, both technical (forecasting and compensation of load fluctuations, parallel operation of furnaces) and economic (conditions of supply and tariffs, comparison of costs of other sources of heat) in this field.

The second group of papers, on the off-peak utilisation of electricity, showed that geographical conditions and national habits are among the principal factors governing the practice in various countries. Thus whilst electric steam and hot water boilers are widely used in Sweden and Switzerland, a paper by a British author showed that this country was leading the field in respect of storage heating by floor warming. A paper by an Italian author discussed the effect of reduced off-peak and night tariffs on the consumption of electricity for heating purposes, such as storage baking ovens, hot water storage, etc., and gave details of the load characteristics of various appliances based on statistical surveys.

Several papers on tariffs discussed the application of special tariffs for supplies to electric furnaces if use is made of their flexibility to improve the system load factor; much statistical and other interesting material was presented in these papers.

Sales Promotion

The papers on sales and sales promotion all stressed the importance of technical advice being available to existing and prospective electro-heat users from the electricity supply authority and that close personal contact between the engineers of the plant manufacturers, the plant users and the electricity supply undertakings is essential for a successful application of this type of heating. A British paper describing, amongst other matters, tariffs charged to large consumers with high load factors attracted much attention. The papers and the discussions in this Section showed a general agreement on the approach to the technical problems posed by arc furnace loads as well as on the desirability and the measures to be adopted for utilising the flexibility of this type of plant to improve the load curve of supply undertakings. It also showed that in the minds of the delegates there was little doubt that the latter aim can only be attained by an adequate tariff policy, and the availability of sound technical and economic advice to the user.

The large number of papers in *Section X* dealt with a variety of subjects some of which could be included under this heading only in a wider sense. Time permitted of

only limited discussion and by the same token only a small proportion of the papers can be specifically mentioned here. One paper gave an interesting account of the measurement of temperature distribution and air currents in the main nave of the Basilica of Trier which has an air volume of nearly 2 million cu ft; this nave is provided with floor heating of 512 kW and additional convector heating of 170 kW connected capacity.

A British paper dealt with high speed cinematography of sustained power arcs and in connection with this an excellent film was shown which attracted much attention. A Dutch paper described experiments to establish the useful life of conductor materials for resistance elements and a German paper gave detailed accounts of the results of experiments carried out with dielectric drying of porous materials such as wood by short high frequency impulses, as already mentioned, and gave a comparison of the energy consumption of this and the continuous dielectric method. A Swedish paper described the manufacturing process of "Kanthal-Super-Elements," for the invention of which B. v. Kantzow had received the medal of the International Electro-heat Union at the opening session of the Congress. The discussion of papers on radio interference by industrial high frequency equipment disclosed the feeling of many delegates that the telecommunication authorities should contribute to the solution of the problem by allocating more wavelengths and in other ways, and the wish that the Electro-heat Union should participate in negotiations through the International Electrotechnical Commission. A summary report dealt with the progress in high frequency generator design in recent years. A paper advocating the establishing of a special section on electro-heat in the Universal Decimal Classification system received much support from the delegates, as did a proposal to introduce international safety rules for electro-heat equipment.

During the Congress, a number of technical films were shown, including three from Great Britain. The latter included the excellent film on power arcs already mentioned, a film on surface heaters and the new colour film on industrial electric heating of the British Electrical Development Association, which had a very favourable reception.

The foregoing is of necessity only a very incomplete account of the proceedings and many valuable papers could not be mentioned for reasons of space. However, this brief account should not conclude without a few words on the organisation of the Congress and the technical visits that formed a part of the programme. This was excellent, but an improvement could nevertheless be made at future Congresses by the exclusion of papers of too specialised or too general a nature, thereby conserving more time for discussions. The same aim could also be furthered by the provision of simultaneous translations at all sessions. Last, but by no means least, the organisers of any future Congress should be strict in refusing all papers, without exception, submitted after the closing date set for this purpose, to ensure that the printers, the reporters and the delegates are all given sufficient time to do their respective duties.

Problems in Uganda

THE Uganda Electricity Board's eleventh annual report, for the year ended 31st December last, records steady progress, with an increase of over 20 per cent in the number of consumers and of 22 per cent in electricity sales within Uganda itself. During the first year of the bulk supply to Kenya from the Owen Falls station, 90 million kWh was sold. Transmission and distribution lines were extended by 592 miles making a total of 1,887 miles at the end of 1958. This resulted from excellent progress in the implementation of the Board's policy to extend the benefits of electricity to the rural areas of the Protectorate.

Revenue amounted to £1,393,987, an increase of £286,622 compared with 1957, but in spite of this the Board finished the year with a small deficit of £2,231. Over 70 per cent of revenue was absorbed by capital charges. Referring to this, the Board says that, like many other organisations, it is finding current interest rates an increasingly heavy burden. By the end of the year it had become clear that over £6 million of short-term money would have to be replaced by a long-term loan at a much higher interest rate. A substantial deficit in 1959 was inevitable and accordingly a tariff revision was necessary. Recommendations made to the Government were approved and revised tariffs, framed to result in an overall increase in revenue of about 13½ per cent, were recently introduced in areas supplied from the Owen Falls station. This was the first increase for six years, during which there had been a decrease in charges of 5 per cent.

It was still necessary during 1958 to capitalise interest to the extent of £372,528 compared with £446,339 in 1957. The early cessation of capitalisation is one of the principal aims of the Board at present. By 1960 it is estimated that £3 million will have been charged to capital account. The effect of this is that for the next 40 years consumers will have to pay interest on interest, plus redemption charges, equivalent together to about £200,000 per annum.

The Board points out that the curtailing of development would not be an answer to the problem of interest charges because all new capital expenditure is required to meet its own costs and also contribute something towards the cost of the Owen Falls scheme. Distribution development is, in fact, still inadequate to absorb all the power available, and much more will need to be spent before revenue becomes sufficient for all fixed and running costs. In the early years of construction of the Owen Falls station is was expected that by 1958 three-quarters of the revenue would come from large-scale industrial development, and it was designed for that purpose. In the event, industrialisation has fallen far short of expectations. Last year only 16 per cent of revenue came from industry, 10 per cent from the bulk supply to Kenya, and no less than 74 per cent from ordinary power, commercial and domestic consumers. By a vigorous policy of extending the supply to remote parts of the country the Board has been able to maintain a steady growth of sales, otherwise the financial position would have been more difficult.

A total of 278·4 million kWh was generated last year compared with 148·8 million in 1957. The seventh 15 MW set at Owen Falls was commissioned in May, 1958, and the installation of the eighth set was in hand, as well as the embedded parts of Nos. 9 and 10. The Board's consulting engineers made good progress with the design of the projected new dam and power station (Bujagali) about 4½ miles downstream from Owen Falls, from which it will be remotely controlled. This station will house four 45 MW sets. Two small hydro-electric projects (at Karuma Falls on the Nile and on the Nyakizumba River) are also being investigated.

GENERATION AND DEVELOPMENT

Rural Plans Held Up

Speaking at a meeting of the Midlands Electricity Consultative Council, Ald. H. Goodwin alleged that electricity supply schemes in the Leek rural area were being held up because of "obstruction" by the Peak Planning Board. Schemes for such villages as Flash and Stanton had been approved, he said, but the Planning Board would not agree unless the cables were placed underground, and that would make the cost prohibitive. It was decided to send a protest to the Board.

Floor Heating in Flats

At the annual regional housing and planning conference of local authorities which was held at Bridlington recently, Mr. S. Holmes, chief heating engineer of Leeds Corporation, said that the heating of multi-storey flats by electrical floor warming was "a good proposition." Mr. Holmes gave details of his experience with new blocks of flats at Saxton Gardens, Leeds, and the redevelopment of an area in York Road. The under-floor scheme's advantages included cheapness of installation, shortening of building programmes, saving in construction, and cleanliness. The flats could also be all-electric, thus reducing services. The disadvantages of the system, he said, were that it possessed no reserve against severe weather and electric power might be cut off.

Reinforcement Schemes

Particulars of 89 schemes for mains reinforcement or extension recently approved by the East Midlands Electricity Board were submitted to the Electricity Consultative Council at its meeting at Nottingham on 3rd June. It was pointed out that, of the total expenditure involved, estimated at £880,200, £694,800 was to be spent on reinforcement and standardisation of supplies in various parts of the Board's area.

OVERSEAS

High Voltage Arctic Line

A 200 kV power line 67 miles long between Petäjäskoski on the Kemi River, Finland, and Kalix, in Arctic Sweden, was put into operation recently. The new line connects the Finnish network with the interconnected Swedish and Danish networks. The line, which has a capacity of approximately 200 MW, is initially being used to export surplus power to Finland from the hydraulic plants on the rivers in southern Norrland, where the spring flood has begun.

Argentine Contracts

The Argentine Department of Water and Electricity has awarded a contract worth U.S. $112 million to a consortium of Italian and German firms who are to supply and install over 280 miles of 132 kV oil-filled cable in connection with the new Buenos Aires power station. According to the *Fortnightly Review* of the Bank of London & South America, Ltd., half the cable will be manufactured in Argentina by Pirelli S.A.I.C. and the balance by Pirelli of Milan, Felten & Guillaume of Cologne, and Siemens-Schuckert of Berlin. Pirelli, Ltd., of London, will supply all the raw materials required by the Pirelli companies. A contract has also been awarded to a local firm for the construction and supply of equipment for a 24 MW transformer station near San Paul.

The Goliath crane at Hinkley Point nuclear station site was completed recently when the 650 ton, 250ft. long bridge was hoisted into its final position 235ft above the ground

Pole Erection by Helicopter

The Okanagan Helicopter Group of Vancouver has completed a unique industrial project in California. In five days, using a Sikorsky S-58, the company planted 107 45ft poles weighing up to 1,700 lb each over a seven-mile stretch near Santa Ana. The poles, completely rigged with cross-arms and stay cables, were carried a maximum distance of seven miles and dropped individually into pre-dug holes. At a related project 100 miles away, up to 38 cu yd of pre-mixed concrete was dropped daily into foundation forms for steel pole footings. Officials of the company said that the two projects were completed at 50 per cent of total costs estimated by the California Edison Company.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 3rd July:—

Nos. 776,370 and 776,373 (design). Class 9. Discharge tubes (not for lighting purposes), high-frequency signalling apparatus and high-frequency measuring instruments, all being electric, and parts. Nos. 776,371 and 776,374 (design). Class 10. Electro-medical apparatus and instruments and parts. Nos. 776,372 and 776,375. Class 11. Electric high-frequency cooking and drying apparatus; electric high-frequency heating apparatus; and parts.—Miwag Mikrowellen A.G., Basle, Switzerland. Address for service, c/o J. Y. and G. W. Johnson, 47, Lincoln's Inn Fields, London, W.C.2.

Morfax. No. 780,467. Class 9. Electrical apparatus and instruments.—Morfax, Ltd., Willow Lane, Mitcham, Surrey.

Helixyn. No. 782,024. Class 9. Electrical apparatus and instruments; electric and electronic installations for use in the automatic control of industrial operations; and parts.—British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

Frigéfrance. No. 783,956. **Frigeurop.** No. 783,959. Class 9. Scientific and electrical apparatus and instruments, etc.—Frigeco, Paris, France. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

Tedelex. No. 783,675. Class 9. Electric polishing machines (domestic), electric vacuum cleaning apparatus, electric flat irons, kettles, toasters, radio apparatus, loudspeakers, gramophones, record players and record changers; and parts.—Television & Electrical Distributors (Pty.), Ltd., Johannesburg, South Africa. Address for service, c/o Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

Controver. No. 785,854. Class 9. Electronic apparatus for automatically controlling the operation of industrial machinery and apparatus in accordance with predetermined circumstances.—Timothy Eaton, Ltd., Thornfield Laboratories, Macclesfield Road, Alderley Edge, Ches.

Diavu. No. 786,374. Class 9. Electrical apparatus and instruments, photographic and cinematographic apparatus and instruments; and parts.—H.L.M. Blanchette, 9, Cornwall Gardens Walk, London, S.W.7.

NEW ELECTRICAL EQUIPMENT

Adjustable Worklight

A safety model primarily for use in telephone exchanges, relay rooms, radio stations and similar electrical installations, has recently been added to the range of adjustable, portable, fluorescent lights manufactured by P. W. ALLEN & CO., 253, Liverpool Road, London, N.1.

The new type A.103/D light consists of a 2in 20 W fluorescent tube contained in a metal reflector with a clear front panel of "Perspex" or armour plate glass. The reflector is attached

Allen fluorescent worklight

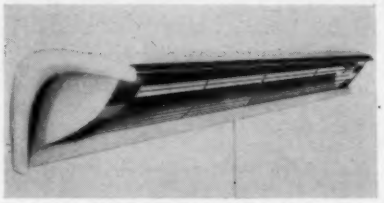
to a hollow cast base containing the control gear through an adjustable joint, and may be positioned to throw light in any direction. The electrical equipment is double insulated in accordance with B.S. 2754.

The model is finished in silver grey hammertone stove enamel and with all small metal components plated, and a wooden base plate is fitted to prevent damage to polished or composition floors. The standard model is suitable for connection to a 200/250 V 50 c/s a.c. supply, though units are available for operation from non-standard voltages and frequencies. The price is £24 and delivery is approximately six weeks.

Infra-Red Heaters

Two new "Becosil" infra-red heaters, models 707 and 708, have been introduced by the GATEHILL MANUFACTURING CO., LTD., Kennard Road, Stratford, London, E.15. The heaters are designed for wall mounting and a safety angling device enables them to be traversed over a radius of 90 deg. Each heater is fitted with a hinged guard to facilitate cleaning and a pull switch with nylon cord.

Model 707 is available in 400, 550 or 800 W loadings, weighs 5 lb, and measures 33¾in long by 6in wide by 4in deep. Model 708 is available as a 1,500 W heater only, weighs 6¾ lb and measures 47½in long by 6in by 4in. The standard finish is in white



"Becosil" infra-red heater (Gatehill Manufacturing Co.)

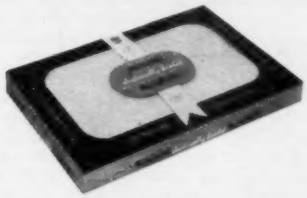
or red but other colours can be had to order. The prices are £4 10s (707) and £8 10s (708), plus 16s 6d and £1 11s 1d respectively for purchase tax.

Low-Voltage Indicator Lamp

A panel-mounted low-voltage indicator lamp fitting for use with l.e.s. cap bulbs, complying with the requirements of B.S. 98/E.5, has been introduced by A. F. BULGIN & CO., LTD., Bye Pass Road, Barking, Essex. The fitting is moulded in thermoplastic and has a push-on grip-washer fixing, for panels from 18 s.w.g. to $\frac{1}{16}$in thick, applied with a tubular tool. Water-clear, red, amber, green or blue moulded transparent snap-in lens caps are available and the fitting accommodates l.e.s. bulbs up to 1·2 W maximum, for a 16 deg C ambient temperature, operating from 2·5 to 28 V supplies. The 3in long wire connecting leads incorporated may be shortened, though connections should not be soldered closer than ¾in from the fitting or with a dwelling time exceeding ten seconds. A black body moulding is normally supplied, but other colours are available to quantity order.

Electric Blankets

The Electrical Appliances Division of PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, announce the introduction of



Philips type EA 1220 electric blanket

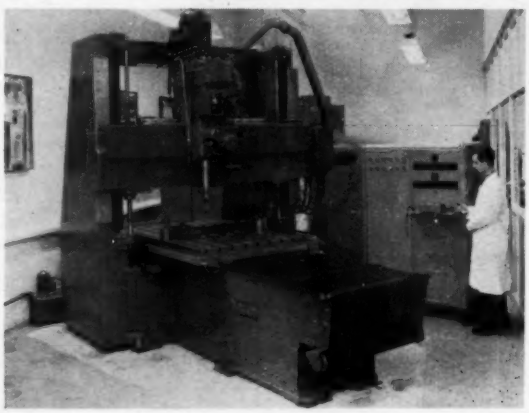
two new additions to their range of electrically-heated blankets, the EA 1220 and the EA 1210. Both blankets, which bear the B.S.I. "Kitemark" and the seal of the Good Housekeeping Institute, are known as the "Standard" range. They are made of a fleecy, gold coloured, woollen mixture material and are fitted with a rotary on/off switch. The heating element, as is the case with other blankets in the Philips range, is plastic covered, and the entire blanket is flame-proofed.

The EA 1220 (60 × 43in) is priced at £6 9s 2d plus £1 3s 7d purchase tax and the EA 1210 (60 × 25in) costs £4 8s 2d plus 16s 1d purchase tax. They are available in two voltage ranges, 200/210 and 230/240, and the respective loadings are 125 W and 72 W.

The company's two existing blankets, types EA 1213 and EA 1223, will now be known as the "De Luxe" range.

Electronically Controlled Drill

An electronically controlled positional drilling machine, having a guaranteed positional accuracy of ±0·001in, has been developed by E.M.I. ELECTRONICS, LTD., Hayes, Middlesex, in collaboration with WADKIN, LTD. The model TCD.1 machine is designed with anti-friction slides and precision recirculating ball, nut and screw device to exploit the high degree of accuracy possible with



The E.M.I./Wadkin drilling machine

an electronic control system. It has a work table measuring 3ft 6in by 5ft 6in, and the drill head is mounted on a cross beam supported on twin vertical columns to provide extra strength and enable drills to be fed directly into steel without the occurrence of "break-through" problems.

The drilling head has twelve spindle speeds from 60 to 1,500 r.p.m., with a feed rate from 0·004in to 0·03in per revolution. The drilling capacity in mild steel is 2in diameter without a pilot hole being necessary, but up to 3in diameter holes can be drilled at a reduced feed rate. Both the table and drilling head are automatically locked during each drilling cycle. In addition to a hand control for initiating the feed when the machine is being used for a few holes on prototype work, an automatic control is employed operating from either punched tape or dial settings.

No marking out or drilling jigs are required. For batch production a tape is prepared from a table of information giving positions of the holes to be drilled in relation to a datum point. For single unit production, co-ordinate points can be set on a series of dials. The price of the machine, complete with electronic control, is expected to be about £10,000.

Home Laundry Equipment

The "Wash-O-Magic" home laundry machine marketed by ELLIOTT DOMESTIC APPLIANCES, LTD., Victoria Works, Victoria Road, Willesden, N.W.10, is a combination washing machine and spin dryer. It is fitted with a 3 kW heater, and washing is carried out by turbo-agitation. The spin dryer compartment has an automatic spray ring which enables clothes to be rinsed with clear water straight from the tap after soapy water has been returned to the washing drum by pump action. The controls, mounted on top of the machine, consist of a heater, a pilot light, a time control clock, and a master control. The cabinet is finished in white vitreous and stoved enamel, with gilt and chromium trim, and measures 33in high by 30in wide by 22in deep. Castors are fitted for easy movement. Each machine is supplied with a pair of hardwood boiling tongs and the price, including purchase tax, is £90 6s. An attractive working table top is available as an extra, price £2 17s 6d, including tax.

Elliott "Wash-O-Magic" home laundry machine

The A.E.I. "Series 2" family power pack incorporates new control gear, including a starter switch half the conventional size

Industrial Vacuum Cleaner

The latest in the range of industrial vacuum cleaners manufactured by the STURTEVANT ENGINEERING CO., LTD., Southern House, Cannon Street, London, E.C.4, the "Six-X-Three," is a mobile unit, capable of turning in its own length, with a large dust container. The three-stage turbo-exhauster is driven by V-ropes from a 3 h.p. three-phase continuously rated motor. A complete range of tools for cleaning floors, walls, pipes, beams, etc., is available. The overall dimensions are 5ft 2in high by 2ft wide by 3ft 3in long.

Sturtevant industrial vacuum cleaner

Fluorescent Fittings

A new range of industrial and commercial fluorescent lighting fittings, the "Series 2" family, has been introduced by the A.E.I. LAMP & LIGHTING CO., LTD., Melton Road, Leicester. The hundred fittings in the range are designed round the new "Mazda" bi-pin 5ft fluorescent lamp and have similar features to those pioneered by A.E.I. in their first "family" range, which was based on standardised gear channels with a number of interchangeable reflectors and diffusers.

Lessons learned from the first range have resulted in a number of design improvements and in price reductions averaging about 10 per cent. Bi-pin telescopic holders allow lamping from one end only and make a reduction of about 2in in the length of the fittings.

The "Series 2" gear channel is pressed from heavy gauge sheet steel to a new cross section stronger than the rectangular section used for the first "family" range. Wiring is "Neoprene" insulated and colour-coded throughout, and securely held in position by insulated tags. Three-way fused connector blocks are used in all fittings.

The fixing arrangements for the power pack are even more flexible than those provided by the original "family" range. Besides the provision for the established 42in fixing centres in the back plate for conduit or screw fixing, a separate channel attachment is available, which serves as a dust cover and provides three alternative fixing centres for conduit entry. With the aid of two fixing straps the same cover turned upside down will give any fixing centres between 18 and 48in.

Monitoring Relay

The three-phase supply monitoring relay, originally developed by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., of Rugeley, Staffordshire, to operate in conjunction with automatic starters for standby diesel-alternator plant, is designed to provide protection against complete failure of one, two or three phases of a 380/440 V three-phase supply. The unit also includes facilities to provide a signal when any phase voltage is reduced to between 80 and 95 per cent of nominal value, operating when the voltage falls to within ±1 per cent of any set point in this range.

The relay, designated Series MFR.1, is contained in a fabricated sheet steel case having overall dimensions of 15½in by 11¾in by 6½in. This compact assembly can be housed in control cubicles or fitted as a separate wall-mounted unit.

Three long-life valves are used in the control circuits which are arranged to fail-to-safety.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

35277. Siemens Edison Swan, Ltd.—Electrical switching systems. 16th September, 1955. (814882.)

5981. Tinsley & Co., Ltd., H.—Means for stabilising the voltage or current output of electrical apparatus. 1st June, 1955. (814883.)

7930. Metropolitan-Vickers Electrical Co., Ltd.—Saturable core reactance devices or magnetic amplifiers. 16th June, 1955. (814884.)

17621. British Telecommunications Research, Ltd.—Electric carrier telegraph systems. 10th June, 1955. (814887.)

17996. Cockram, R. W. J.—Electric switches of the limited gap snap-action type. 20th June, 1955. (815082.)

25315. Edwards & Co. (London), Ltd., W.—Vapour vacuum pumps. 22nd September, 1955. (815051.)

30296. Electric & Musical Industries, Ltd.—Ovens. 21st October, 1955. (814889.)

1955

576. Associated Electrical Industries, Ltd.—Electron lens apparatus. 3rd January, 1956. (815062.)

2320. Automatic Telephone & Electric Co., Ltd.—Automatic telephone exchanges. 9th December, 1955. (Addition to 718056.) (814943.)

4804. Metropolitan-Vickers Electrical Co., Ltd.—Linear electron accelerators. 16th February, 1956. (815063.)

7893. Cole, Ltd., E. K., and Davis, R. G.—Apparatus using a radioactive material and an ionisation chamber. 19th March, 1956. (814890.)

12732. Electric & Musical Industries, Ltd.—Means for shifting the electron beam of a cathode-ray tube. 1st May, 1956. (814892.)

16805. Holzer, W.—Cam-actuated electric switch. 10th June, 1955. (815087.)

19875. Thorn Electrical Industries, Ltd.—Devices employing electro-luminescence. 19th June, 1956. (815089.)

20405. Sparcatron, Ltd.—Electric disintegration of conductive materials. 27th June, 1956. (815090.)

25541. General Electric Co.—Refrigerating systems. 6th September, 1955. (815092.)

26340. Metropolitan-Vickers Electrical Co., Ltd.—High vacuum systems having oil vapour diffusion pumps. 12th September, 1956. (815067.)

27184. International Business Machines Corporation.—Semiconductor devices. 23rd September, 1955. (814896.)

31003. Automatic Telephone & Electric Co., Ltd.—Automatic telephone exchanges. 29th October, 1955. (814944.)

36822. British Telecommunications Research, Ltd.—Electrical signalling systems particularly telephone or like systems. 18th December, 1956. (Addition to 791856.) (814901.)

1956

1759. Thorn Electrical Industries, Ltd.—Coils for electrical apparatus. 18th December, 1956. (815106.)

2530. Edwards High Vacuum, Ltd.—Vacuum pumping apparatus. 22nd January, 1957. (815070.)

4327. Telefonaktiebolaget L. M. Ericsson.—Telephone exchanges having subscribers' lines with different privileges. 10th February, 1956. (815152.)

4533. Telefunken G.m.b.H.—Circuit arrangements for generating sawtooth currents. 14th February, 1956. (814969.)

5201. Permutit Co., Ltd.—Electrodialysis processes. 7th February, 1957. (815154.)

6337. Philips Electrical Industries, Ltd.—High-voltage rectifying systems. 29th February, 1956. (815109.)

7836. Diamond H Switches, Ltd.—Electrical energy regulators. 13th March, 1957. (815111.)

9922. Licentia Patent-Verwaltungs-G.m.b.H.—Insulating and corrosion protection for rectifier plates. 29th March, 1956. (815113.)

11813. British Thomson-Houston Co., Ltd.—Cooling of fluids. 16th April, 1957. (815114.)

14409. British Thomson-Houston Co., Ltd.—Radar equipment. 6th May, 1957. (814980.)

17592. Picker X-Ray Corporation Waite Manufacturing Division, Inc.—Beam controlling device for high energy rays. 7th June, 1956. (815118.)

18411. Marconi's Wireless Telegraph Co., Ltd.—Duplex radio communication systems. 4th March, 1957. (814984.)

18469. Sylvania Electric Products, Inc.—Electric lamp making machinery. 14th June, 1956. (814985.)

23995. Kienzle Apparate G.m.b.H.—Device for the conversion of electrical input information. 3rd August, 1956. (814994.)

25333. Rotax, Ltd.—Electromagnetic electric switches. 12th August, 1957. (814906.)

25613. United Kingdom Atomic Energy Authority.—Apparatus for handling nuclear reactor fuel elements. 22nd July, 1957. (814996.)

26588. Commonwealth Scientific & Industrial Research Organisation.—Method and apparatus for determining and controlling the moisture content of dielectric materials. 30th August, 1956. (815000.)

28313. Lucas (Industries), Ltd., J.—Snap-action electric switches. 5th September, 1957. (815126.)

28467. Cambridge Instrument Co., Ltd.—Electrical recording systems. 18th September, 1957. (815004.)

29793. Cole, Ltd., E. K., and Hart, G. H.—Inductance coils. 30th September, 1957. (815127.)

30621. Radio Heaters, Ltd.—High frequency electric heating apparatus. 8th January, 1958. (815129.)

30758. Metropolitan-Vickers Electrical Co., Ltd.—Cam-operated electrical contactors. 19th September, 1957. (815078.)

35213. Wingrove & Rogers, Ltd.—Lead-through or stand-off insulated terminals. 7th November, 1957. (815135.)

37338. Engelhard Industries, Ltd.—Manufacture of electrical contacts. 17th October, 1957. (815136.)

38293. Standard Telephones & Cables, Ltd.—Regulated electric power supply equipment. 14th December, 1956. (Addition to 776550.) (815016.)

1957

1562. Bosch G.m.b.H., R.—Commutator type dynamo-electric machines. 16th January, 1957. (814911.)

2982. Philips Electrical Industries, Ltd.—Resistors having a negative temperature coefficient. 28th January, 1957. (814913.)

3247. Westinghouse Air Brake Co.—Circuit arrangement for controlling means for measuring the speed and rolling resistance of railway cars. 30th January, 1957. (815018.)

4640. Plessey Co., Ltd.—Resistors and resistor materials. 18th February, 1958. (Cognate application 15369, 15th May, 1957.) (814914.)

5212. Standard Telephones & Cables, Ltd.—Two-channel radio beam antenna arrangement. 15th February, 1957. (815178.)

6951. Metropolitan-Vickers Electrical Co., Ltd.—X-ray tubes. 28th February, 1958. (815025.)

7070. Triflux Soc.—Means for the progressive lighting of electric discharge tubes. 4th March, 1957. (814916.)

11086. Sperry Rand Corporation.—Pulse receivers. 4th April, 1957. (815138.)

12806. Siemens & Halske A.G.—Tuned electromagnetic relays. 18th April, 1957. (815034.)

14171. Western Electric Co., Inc.—Gaseous discharge devices. 3rd May, 1957. (814952.)

14557. Foxboro Co.—Electromagnetic flowmeters. 7th May, 1957. (815192.)

14956. Collins Radio Co.—Phase detector fault indicator. 10th May, 1957. (815038.)

16578. Bendix Aviation Corporation.—Microwave antenna system. 24th May, 1957. (814921.)

20031. Graell, A. C.—Control circuit for electrical discharge metal machining apparatus. 25th June, 1957. (815041.)

23936. Telefunken G.m.b.H.—Manufacture of transistors and other semiconductor devices. 29th July, 1957. (815208.)

23977. General Electric Co.—Electric mercury button switch. 29th July, 1957. (815142.)

25958. Amp, Inc.—Electrical connectors and methods of applying them. 16th August, 1957. (815044.)

26321. Western Electric Co., Inc.—Gaseous discharge devices. 20th August, 1957, (814953.)

39659. Engelhard Industries, Inc.—Operating circuits for electric discharge lamps. 20th December, 1957. (814936.)

1958

6395. Koehler Manufacturing Co.—Sealed electric cells with auxiliary electrodes. 27th February, 1958. (815023.)

1959

2270. Clavel, J.—Rotary electric switches. 31st August, 1955. (Divided out of 814528.) (815150.)

Mining Machinery Exhibition

An exhibition of mining machinery and symposia on shaft sinking and tunnelling are to be held at Olympia in July. The exhibition will run from 9th to 18th July and the symposia will be held on the 15th, 16th and 17th. It is ten years since the last exhibition of mining equipment was held and the Council of Underground Machinery Manufacturers in promoting this exhibition is seeking to demonstrate the advances in mining technique and design of mining equipment made in Great Britain during the last decade. The exhibition will be opened on Thursday, 9th July, by the Minister of Power, Lord Mills. Admission will be by ticket, obtainable in advance from the exhibitors, the secretaries of the Council of Underground Machinery Manufacturers, or the exhibition organisers, the Municipal Agency, Ltd., 70, Little Victoria Street, London, S.W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Aberdare.—U.D.C. Street lighting equipment. (See this issue.)

Australia.—Metropolitan Water, Sewerage and Drainage Board, Sydney. 14th July. Two electrically driven centrifugal pumping units. (E.S.B. 13152/59. Ten/39450.)*

Bridport.—Corporation. 11th July. Equipment for Groups "A" and "B" street lighting. (See this issue.)

Carshalton.—U.D.C. 2nd July. Street lighting equipment. (See this issue.)

Ceylon.—Tender Board, Colombo. 8th July. Overhead system cables and protected aerial cables. (E.S.B. 13371/59. Ten/39494.)*

Durham.—County Council. Electrical installation in Consett Fire Station, Blaydon Magistrates' Courts and Darlington Police Station and Courts. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. 275 kV transmission line between Kintore and Tealing. (See this issue.)

Hertfordshire.—County Council. 1st July. By-pass lighting equipment. (See this issue.)

India.—Madras State Electricity Board. 25th June. House service meters. (E.S.B. 13824/59. Ten/39575.)*

Iraq.—Iraqi Ports Administration, Basrah. 28th June. Five radio transmitters and eleven receivers. (E.S.B. 13277/59. Ten/39487.)*

Directorate General of Posts and Telegraphs. 8th July. Telephone and telegraph poles and line fittings. (E.S.B. 13250/59. Ten/39483.)* Automatic exchange. (E.S.B. 13249/59. Ten/39486.)*

Kendal.—Corporation. 10th July. Group "A" street lighting equipment. (See this issue.)

Knighton.—U.D.C. 24th June. Street lighting equipment. (See this issue.)

Manchester.—City Council. 30th June. H.v. and l.v. switchgear for new terminal building, Manchester Airport. (See this issue.)

Old Fletton.—U.D.C. 4th July. Street lighting equipment. (See this issue.)

Pakistan.—Department of Supply and Development, Karachi. 23rd June. Electric cable, copper conductors and binding wire. (E.S.B. 13887/59/I.C.A. Ten/39643.)*

Rhodesia and Nyasaland. — Electricity Supply Commission, Salisbury. 23rd July. Two 20/30 MVA transformers for Bulawayo. (E.S.B. 13160/59. Ten/39527.)*

Rushden.—U.D.C. 27th June. Supply and fitting of electric water heaters in about 60 houses on the Irchester Road estate. A. G. Crowdy, clerk, Council Buildings.

South Africa.—Union Tender Board, Pretoria. 29th June. 100 transistor high tension power supplies for use in conjunction with radio apparatus. (E.S.B. 13097/59. Ten/39490.)*

Stores Department, South African Railways, Johannesburg. 3rd July. 6·6 kV and 400/231 V switchboards. (E.S.B. 13813/59. Ten/39565.)*

Sudan.—Central Electricity and Water Administration, Khartoum. 23rd June. 11 kV and 1,100 V cables. (E.S.B. 13476/59. Ten/39506.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bournemouth.—Corporation Fire Brigade Committee. Electrical installation in the new Redhill Park Fire Station (£1,400).—T. W. King.

London. — South West Metropolitan Regional Hospital Board. Recommended. Three bed and passenger lifts at St. Lawrence's Hospital, Caterham (£10,020).—Marryat & Scott.

Luton.—R.D.C. Provision of 54 lighting points for lighting the London-Holyhead trunk road at Hockcliffe (£3,664).—Engineering & Lighting Equipment Co., Ltd.

Sheffield.—Corporation Water Committee. Diesel engine driven 70 kW alternator, with ancillary equipment (£2,768).—National Gas & Oil Engine Co.

Stockport.—Corporation. Recommended. Electrical installations in 143 dwellings (£6,571) and in 22 dwellings (£1,035).—Hobson & Sott.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Basingstoke.—Extensions to Queen Mary's Grammar School and the County High School; county architect, The Castle, Winchester.

Bath.—Central police station, Manvers Street; J. Wilkinson, planning officer, 7, North Parade Buildings.

Bedlington.—Flats (70), Guide Post; William Leech, Ltd., builders, St. James Street, Newcastle-on-Tyne.

Birkenhead.—Four-storey showroom and office block, Hamilton Street; H. Watson & Co. (Liverpool), Ltd., 13, Canning Place, Liverpool.

Blackpool.—Erection of freighter garage; A. Hamilton, borough surveyor, P.O. Box 17, Municipal Buildings.

Bradford.—New central library, Manchester Road/Little Horton Lane site, and extensions to Town Hall; W. Clifford Brown, city architect.

Bristol.—Television studios and offices, Brislington; T.W.W., Ltd., 187, Oxford Street, London, W.1.

Additional three-storey building for College of Technology, Ashley Down; city architect, Council House, Bristol, 1.

Clutton (Bristol).—Bungalows (24) and flats (16); Thomas & Morgan & Partners, architects, 23, Gelliwasted Road, Pontypridd, Glam.

Darlington.—Houses (130), Nestfield Farm; Edgar Lawson, Ltd., builders, Alliance Works, Albert Hill, Darlington.

Edmonton. — Ten-storey office block; borough architect.

Glenrothes.—Erection of five factories; P. Tinto, planning officer to Development Corporation, Woodside, Glenrothes, Markinch, Fife.

Hamilton.—Houses (270), Earnock; burgh surveyor.

Harlow.—Office block (£80,000); Kirk & Kirk, Ltd., builders, Atlas Works, London, S.W.15.

Haverhill.—Factory for Mansol, Ltd., Fountain Road, Thornton Heath; Kerridge, Ltd., builders, 24, Sturton Street, Cambridge.

Offices and factory extensions; J. C. Myers, architect, High Street.

Hove.—Thirteen-storey block of flats, The Drive; Gotch & Partners, architects, 26, Regency Square, Brighton.

Inverness.—Houses (71), Cowan Street; burgh architect, 11, High Street.

Leicester.—Further 304 houses, Eyres Monsell estate; John Laing & Son, Ltd., Thurnby, Leics.

Letchworth.—Extensions to grammar school; C. H. Aslin, county architect, County Hall, Hertford.

Lincoln.—Flats and bungalows (78), Princess Street redevelopment area; R. R. Alexander, city architect, Stamp End.

London.—Hotel and shops, Cadogan Place and Sloane Street, Chelsea; Sir Robert McAlpine & Sons, Ltd., 80, Park Lane, W.1.

Extensions (£250,000), Avery Hill Training College, Eltham; D. Dex Harrison, architect, 34, Holland Park Road, W.14.

Flats, Ormonde Close, Holborn; John Laing & Son, Ltd., Bunns Lane, N.W.7.

Luton.—Bungalows (42), The Furrows; T. W. H. Dick, architect, 1, Bridge Parade, Winchmore Hill, N.21.

Lytham St. Annes.—Factory, Preston Road; A. L. Talbot, Ltd., 349, Clifton Road North.

Manchester.—Eight-storey offices, York Street/Mosley Street corner site, for William Deacon's Bank, Ltd.; H. S. Fairhurst & Son, architects, 55, Brown Street, Manchester, 2.

Middlesbrough.—Mineral water factory, Lower Gosford Street; E. W. Chapman, architect, 125, Acklam Road, Thornaby-on-Tees.

Newcastle (Staffs.).—Civic Centre, Merrial Street; borough engineer, Lancaster Buildings, High Street, Newcastle-under-Lyme.

Newcastle-on-Tyne.—Two old people's homes (£135,000); city architect, 18, Cloth Market.

Office block, Brinkburn Street, for J. Wilson, Ltd.; Hadden & Hillman, Ltd., builders, North View West.

First stage of rebuilding St. Mary Magdalene Hospital (£90,000); R. Bowey & Son, contractors, South Gosforth, Newcastle-on-Tyne.

Northampton.—Flats (136) in two 12-storey blocks, Bath Street area; borough architect.

Nuneaton.—Erection of South High School; county architect, Shire Hall, Warwick.

Oxford.—Four-storey factory; Pressed Steel Co., Ltd., Garsington Road.

St. Helens.—Erection of head offices, canteen, etc., Alexandra Drive; Pilkington Bros., Ltd.

Sheffield.—Works and offices, Tenter Street; Freeman, Oakes & Co., Ltd., 16, Fitzwilliam Street.

Staveley.—Netherthorpe Grammar School extensions (£38,224); county architect, Matlock.

Sutton (Surrey).—Hospital and laboratories, Fursedown Road, Belmont; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Welshpool.—Erection of new high school, Erw Wen (£110,000); county architect, County Offices.

West Bromwich.—Bakery, Kelvin Way; British Bakeries, Ltd., Millocrat House, Eastcheap, London, E.C.3.

Whiston.—Houses (300), Sugar Lane, Knowsley; R.D.C. surveyor, Delph Lane, Whiston, near Prescot.

Whitstable.—Industrial estate, Thanet Way; E. D. Mills, architect, 16, Carlisle Street, London, W.1.

Wigton.—Proposed new offices for the R.D.C.; W. H. D. Summers, surveyor.

INDEX

Reference Table

PAGES	ISSUE	PAGES	ISSUE
1–46	2nd January	623–664	3rd April
47–92	9th „	665–708	10th „
93–138	16th „	709–754	17th „
139–184	23rd „	755–798	24th „
185–242	30th „	799–842	1st May
243–288	6th February	843–884	8th „
289–332	13th „	885–926	15th „
333–378	20th „	927–970	22nd „
379–422	27th „	971–1026	29th „
423–470	6th March	1027–1078	5th June
471–536	13th „	1079–1124	12th „
537–578	20th „	1125–1166	19th „
579–622	27th „		

We regret that owing to a printing dispute we were unable to publish the "Electrical Review" for Friday 26th June 1959. This index is, therefore, complete to Friday 19th June 1959

ACADEX Engineering Co., New works of, 1057
Accidents, Electrical: Ministry of Labour 1957 report on, 48, 76; Factory, 854
ACC-Vickers-Babcock, Formation of, 221
Acme Wringers, Change of name of, 70
Acoustic design of studios, by C. L. S. Gilford, 25
Acton street lighting modernisation scheme, 329
Adequate wiring, 776
Advance Components, Hainault factory of, 1020
Advisory Committee on Further Education for Commerce, Report of, 609
A.E.I.-Hotpoint: Expansion programme, 19; National sales conference, 67; Water-heating campaign, 568; Sales competition, 570; Factory extension progress, 952
A.E.I. Lamp & Lighting Co., New Leicester headquarters building of, 856
Aerialite floor and ceiling warming lectures and demonstrations, 165
Air duct friction charts, 789
Aircraft crash, Lec Refrigeration, 910
Aircraft electrical power system, "Vanguard," 244, 248
Aircraft navigational aid systems, Parliamentary questions on, 567
Airfields, The electronic equipment of, by E. H. Bruce-Clayton, 881
Airmec, Exhibition of products of, 241
All-electric flats, 454, 566, 648
All-electric house costs, 271
All-Electric Housing Exhibition, 730
All-electric school, Scottish, 640
Allen, W. H., Sons & Co., Orders received by, 569
Allen West & Co.: Apprentice training school, 222
Alternator regulator, Continuously acting automatic, by T. H. Mason, F. H. Birch and Dr. P. D. Aylett, 290, 309
Alternator rotors, Method of determining stresses in, by Dr. H. Fessler, 759
Alternators: New self-regulating, 229; Brushless, 351, 710; Brushless, by A. W. Ford, 711; Gas turbine, 800, 811; Automatic starting diesel —— installation, 934
Aluminium: Direct extrusion method of cable sheathing, 263; Conductor manufacture in India, 316; —— in electrical engineering, by A. R. Parish, 399; Production of welded —— tube, 533; Street lighting column competition, 570; —— foil and strip for electrical windings, by J. J. Lee, 667, 826; New Zealand project, 728; Handbook on —— cables, 790
Amalgamated Engineering Union annual conference, 844, 869
America, Technical training in, by K. R. Sturley, 717
Amplifier, Large audio, 163
Analogies and models, by J. R. Barker, 580, 581
Appointments service for engineers, 871
Apprentices: Definition of student, 2; Manufacturers' training school, 222; Training of, 723; Non-registration of a contractor's, 825
"Approval" mark, 549, 592, 776
Arbitration, Compulsory, 262
Arc-chutes, Performance of, by J. S. Morton, 447
Architect, Co-operation with the, 186
Arctic transmission line, 1162
Argentina: Turbo-generators for, 221; Diesel-electric locomotives for, 360; Postponement of nuclear power plans, 369; Computer for Buenos Aires University, 406; Hydro-electric scheme contracts, 568; Buenos Aires underground railway project, 621; Equipment contracts, 1162
Armstrong Whitworth, Take-over of Gloster Aircraft division by, 1101
Associated Electrical Industries: Scheme for extra notice of termination of employment, 2; Offer for London Electric Wire Co., 2; Steelworks equipment contract, 21; Military Electronic Apparatus Group, 222; A.E.I.-Gala African campaign, 525; Film about, 683; Reorganisation plans, 1094; Story of the formation of, 1143; Portuguese power station contract, 1144
Association of British Machinery Merchants: General meeting, 568, 685
Association of Consulting Engineers, Annual report of, 1080, 1106
Association of Electrical Machinery Trades: Annual convention, 923
Association of Mining Electrical and Mechanical Engineers: South Wales Branch annual dinner, 638; Annual convention, 1148
Association of Public Lighting Engineers: Annual conference venue, 1016
Association of Scientific Workers: Revised salaries scales, 1101
Association of Supervising Electrical Engineers: Exhibition arrangements, 67; Refresher course, 69; Year Book, 729; Annual dinner, 767; Annual conference, 818, 911
Atmospheric pollution investigation report, 482
Atomic Energy Authority, *see* United Kingdom Atomic Energy Authority
Atomic generator, 166
Atomic heat storage project, 219
Atomic power stations, *see* Nuclear power stations
Atomic research centre scheme, 484
Atomic ship propulsion, 826
Atomic Weapons Research Establishment, Nuclear research at the, 1126
Audio amplifier, Large, 163
Australia: N.S.W. transmission lines, 29, 865; N.S.W. Electricity Commission's annual report, 83, 1061; Oaky River hydro-electric scheme, 183; Victoria Electricity Commission's 1958 activities, 128; News from, 150, 744; V.h.f. radio equipment for Army, 164; Nuclear research reactor, 173; Annual report of Southern Electric Authority of Queensland, 325; N.S.W. power station contracts, 369; Transformers for Tasmania, 452; Snowy Mountains scheme, 455, 688, 907; Import licensing, 609; Sydney electricity tariffs, 649, 1104; Nuclear power in, 685; Analogue computer for, 826; Simmonds Aerocessories' new factory, 1020; J. H. Fenner company in, 1020; Sea-water power scheme, 1061; Tasmanian hydro-electric development, 1061
Austria: Exchange of power with Czechoslovakia, 271; Electrical trade of, 705

Authors—

Acworth, D. G. W., Untapped export opportunities, 190
Aldington, Dr. J. N., Sir Joseph Swan and the development of the electric lamp, 444
Arkinstall, L., Floor warming system maintenance, 251
Aylett, Dr. P. D., T. H. Mason and F. H. Birch, Turbo-generator excitation tests, 290, 309
Barker, J. R., Analogies and models, 581
Beck, A. H. W., High-current-density thermionic emitters, 158
Billing, D. C., Electric refrigerators, 929
Birch, F. H., T. H. Mason and Dr. P. D. Aylett, Turbo-generator excitation tests, 290, 309
Bishop, D. O., and G. S. Brosan, Variable-ratio torque convertor, 777
Bolton, D. J., Financing electricity expansion, 995
Boyse, C. O., P. V. Hunter Memorial Lecture, 112
Brosan, G. S., and D. O. Bishop, Variable-ratio torque convertor, 777
Brown, F. H. S., and J. Henderson, Progress on the first nuclear power stations, 1034, 1086
Bruce, H. H., Off-peak floor heating, 523
Bruce-Clayton, E. H., The electronic equipment of airfields, 881
Brunt, Sir David, Kelvin Lecture, 814
Buist, D. M., The gift of tonques, 1097
Casson, W., Ring main concept, 542
Chapman, D. J. R., H. T. Prior and A. A. M. Whitehead, Transistors for communication equipment, 127
Cherry, Prof. E. C., The conceivable future of telecommunications, 985
Choudhury, S. A., Dynamic braking of a.c. motors, 760

pg 1+2 = TP

Authors—*continued*

Church, H. F., Electrical insulation faults, 291
Clarke, Dr. J. S., and G. J. Hudson, Heavy-oil burning, 264
Clery, A. A., Factory installations, 3
Cooper, B. K., Electronics in the railway industry, 335
Craven, A. T., Teaching of electrical engineering, 672
Cressell, I. G., Transistors and semi-conductor devices, 1045
Crossley, Dr. H. E., Corrosion and deposits in oil-fired boilers, 942
Dadswell, K. E., and F. R. Thompson, Boiler conversion problems, 941
Danel, P., James Clayton Lecture, 38
Davis, J. H., Silicone insulation, 123
Day, L. J., Remote control of distribution networks, 141
Degen, P. L., Survey of Physical Society Exhibition, 159
Dewison, D. A., Power station auxiliary supplies, 808
Dick, D. M. C., and D. Embrey, Speed control of lifts, 245
Embrey, D., and D. M. C. Dick, Speed control of lifts, 245
Evans, R. S., Industrial pH measurement and control, 1114
Fessler, Dr. H., Method of determining stresses in alternator rotors, 759
Ford, A. W., Brushless alternators, 711
Foster, A. P., Coal mining and electricity, 562
Gatliff, P. W. R., Electricity in industry, 981
Gessler, J. K., and T. E. Green, Tests on an electrogyro locomotive, 714
Gilford, C. L. S., Acoustic design of studios, 25
Golds, L. B. S., Economic service period for meters, 479
Green, T. E., and J. K. Gessler, Tests on an electrogyro locomotive, 714
Haigh, C. P., I.E.E. convention on thermo-nuclear processes, 851
Hardwick, E., and N. J. Mackay, The electrical installation at Calder Hall nuclear power station, 170
Harper, G. B., Transformer insulation levels, 587
Hellard, R. B., Electrical manufacturers and building costs, 354
Henderson, J., and F. H. S. Brown, Progress on the first nuclear power stations, 1034, 1086
Horlock, Prof. J. H., Properties of superheated steam, 634
House, P. D., Electric drives in the paper industry, 562
Hudson, G. J., and Dr. J. S. Clarke, Heavy-oil burning, 264
Hughes, A. M., Electrical films at Harrogate, 854
Humphreys, O. W., Lighting and the common weal, 1041
Hyams, C. C., Installation engineering, 1038, 1090
Irens, A. N., "Priority No. 1," 1036, 1087
Jacks, E., Discrimination between h.r.c. fuses, 367
Jackson, R. D., Electric floor heating practice: IV—Economic and basic design considerations, 8; V—Alternative types of system, 55
Jackson, R. F., Nuclear fission, 23
Jesty, E. H., Service connections, 322
Johnson, W., Nuclear power auxiliaries, 49
Kenyon, F., Electricity Consultative Councils, 1006
Khalifa, M. M., Klydonograph for recording switching surges, 157
Lee, J. J., Aluminium foil and strip for electrical windings, 667
Leslie, J. W. J., Hospital electrical installations, 389
McClimont, W., H. M. Richardson and B. Taylor, Tests on boiler refractories, 719
McFadzean, W. H., Exporting to the Middle East, 210
Mackay, N. J., and E. Hardwick, The electrical installation at Calder Hall nuclear power station, 170
Marciandi, V. P., Domestic appliances in the doldrums, 193
Mason, T. H., F. H. Birch and Dr. P. D. Aylett, Turbo-generator excitation tests, 290, 309

Authors—*continued*

Merry, P. E., Electronics in the plastics industry, 693
Misson, P., Tubular turbines, 1081
Moore, J. T., Economics of power station design, 589
Morton, J. S., Performance of arc-chutes, 447
Nelson, H. G., Export competition—a new phase? 187
Palmer, A. M. F., Industry and the House, 261, 439, 593, 817, 1009
Palmer, Prof. L. S., Geo-electric surveys, 300
Parish, A. R., Aluminium in electrical engineering, 399
Parkinson, G. C., Future of the cooling tower, 476
Partridge, A. N., Automobile electrical equipment, 113
Phillips, N. F., Exhibitions on loan, 168
Pitts, J. P., Reliability of paper capacitors, 481
Powell, A. G., Three-phase system harmonics, 149
Prasad, B. K. R., Underground hydro-electric stations, 77
Prior, H. T., D. J. R. Chapman and A. A. M. Whitehead, Transistors for communication equipment, 127
Richardson, H. M., W. McClimont and B. Taylor, Tests on boiler refractories, 719
Rigby, K., Angle measuring oscilloscopes, 296
Sadler, R. E., Problems of railway electrification, 478
Silver, Dr. R. S., Energy balance in feed systems, 312
Squire, P. J., The World Bank, 1012
Stacey, N. A. H., British-European trade, 212
Stonehouse, B. H., Nuclear reactor auxiliaries, 253
Stretch, K. L., Recruitment of professional engineers, 1093
Sturley, K. R., Technical training in America, 717
Sugden, F. E., Faulty wiring and the law, 76; Unsafe premises, 442; Injury by faulty tools, 1122
Sutton, E. J., Installation inspection, 1039, 1090
Swale, W. E., Electronics in the textile industries, 625
Szold, A., Power station coal handling, 95
Taylor, B., W. McClimont and H. M. Richardson, Tests on boiler refractories, 719
Taylor, H. G., New methods, materials and techniques in electrical engineering, 588
Thompson, F. R., and K. E. Dadswell, Boiler conversion problems, 941
Thomson, T. P., Conveyor control systems, 629
Towers, T. D., British transistor applications, 362
Tucker, N. A., Electrical contact materials, 1127
Waldram, J. M., Lighting and architecture, 936
Washtell, C. C. H., Electronic counting techniques, 539
Webb, E. N., Labrador hydro-electric scheme, 16
Westgate, R., Chinese hydro-electric project, 125
Whitehead, A. A. M., H. T. Prior and D. J. R. Chapman, Transistors for communication equipment, 127
Williams, J. N., Small coal in industry, 313
Willison, M. J. L., Standardisation and simplification of switchgear, 562

Automobile electrical equipment, by A. N. Partridge, 113
Automobile fuses, 928
Automobile, Model of electrochemical powered, 410
Avo, Multi-language brochure by, 314

BAHAMAS: Transmission line contract, 222; Radio-telephone contract, 643
Bahrain: Manama "B" power station inaugurated, 1095

Bankruptcies—

Adams, G. A., 135
Allport, A. C., 831

Bankruptcies—*continued*

Ames, F. W., 180
Archer, L. G., 418
Armstrong, A., 831, 917
Ashford, S. A. J., 968
Ball, R. H., 831
Banoff, A., 1113
Barke, J. V., 661
Barnes, G. B., 239, 467
Baxter, E., A. Proctor and G. P. Harrold, 43
Bowen, J. I., 418
Bowes, E., 89
Bowman, J. E., 705
Brackenbury, P. S., 968
Clegg, E. H., 239
Clover, K. R., 1005, 1154
Collier, R., 831
Collins, G. H., 875, 1154
Cracknell, A. S. F., 43
Dickinson, G., and K. G. Dickinson, 705, 1069
Dyke, R. P., and G. J. Roberts, 467, 533
Edwards Electrical & Radio, 1154
Gillon, D., 875, 1005
Gliddon, P. R., and M. E. Gliddon, 968, 1005
Green, N. H., 239, 418
Hanson, K., 917
Harford, O. E., 467
Harrold, G. P., A. Proctor and E. Baxter, 43
Hedger, G. F., 620
Henry, A. M., 661
Hibbert, J. S., 751, 1005
Hunt, A. R., 418, 620, 1005
Keene, N. D., 917, 1154
Kemp, D. R., 968, 1005
King, A., 43
Kinsley, H. C., 89, 776
Landau, B., 533
Lawrence, W. H., 1069, 1154
Lighton, J. F., and A. R. White, 180, 467
Luker, J. W., and H. A. R. Phillips, 180, 328
Mason, F. W., 89, 328, 1113
Monk, F., 776, 1069, 1113
Moore, G., 620
Morley, S. W., 239
Mouncey, H. F., 467
Neidle, M., 135, 776
Norwood, C. A., 751, 1069
Overton, G. R., 328, 418
Peel, L., 89, 776
Phillips, E. G., 1069
Phillips, H. A. R., and J. W. Luker, 180, 328
Pointon, H., 285, 375
Proctor, A., G. P. Harrold and E. Baxter, 43
Rabjohns, R., 239
Revere, Gertrude, 751
Richards, R. R. S., 875, 968, 1069
Roberts, G. J., and R. P. Dyke, 467, 533
Rosindale, W. H., 467, 1113
Salt, W. R. V., 917, 1154
Sharp, L. G., 239
Shaw, A. E., 1113, 1154
Shaw, R. N., 533
Simons, F., 135, 328
Skipper, T., 533
Smith, H., 135
Solomon, G. B., 239
Teleradio Maintenance (London) Service, 875
Thomas, P., 328, 467
Thompson, G. A. B., and A. E. Young, 575, 751
White, A. R., and J. F. Lighton, 180, 467
Williams, E. V., 418, 776
Winslade, R. H., 135
Worsley, C., 328
Young, A. E., and G. A. B. Thompson, 575, 751

Bankside "A" power station, Dismantling of, 864
Battery signalling, Voltage control of, 24
Batti-Wallahs' Society, 268, 451, 642, 871, 1058; Ladies' Night, 596
Belgium, Voltage regulators for, 119
Belling & Co., Cooker manufacture at works of, 747
Benjamin Electric, New catalogue by, 731
Berkeley nuclear power station site: Progress at, 201, 311; Atomic research centre scheme, 484; Equipment for, 1058, 1145
Bersimis II power station, Large water valves for, 119
"Big Ben" centenary, 1058
Bingley smokeless zone plans, 1104
Birmingham ring road lighting, 174
Blind, Employment of the, 1080
Blyth "A" power station, First 120 MW set commissioned at, 28, 381–389

Blyth "B" power station, Pump motors for, 957
Boiler corrosion symposium, 38
Boiler flues, Mobile cleaning unit for, 403
Boiler fuels, 48
Boiler refractories, Tests on, by W. McClimont, H. M. Richardson and B. Taylor, 719
Boilers: Problems on conversion of power station, by K. E. Dadswell and F. R. Thompson, 941; Corrosion and deposits in, by Dr. H. E. Crossley, 942
Boots Pure Drug Co., Beeston power station of, 861
Bow power station, 1143
Bowthorpe Holdings: New Zealand company formed, 871
Bradwell nuclear power station project, Progress of, 201, 613
Braking of a.c. motors, Dynamic, by S. A. Choudhury, 756, 760
Brazil: Furnas Rapids hydro-electric project, 43; Nuclear power projects, 566; Television equipment for, 954; Power expansion in, 1121
Bridge floodlighting installation, 955
British Aluminium Co., Struggle for control of, 94
British Association for the Advancement of Science: 1959 meeting venue, 211, 844, 862; Film awards, 643
British Association of Corrosion Engineers, Formation of, 1146
British Council science courses, 404
British Driver-Harris Co., New office block of, 18
British Electrical and Allied Industries Research Association: Reports, 181, 448, 524, 546, 742, 764, 853, 997, 1085; Discussion on insulation research, 410; Annual report, 859, 886; Annual luncheon, 902
British Electrical and Allied Manufacturers' Association: New director, 48; Contract price adjustment formulæ, 163, 452, 609, 790, 954; Rand Easter Show exhibit, 260; Domestic Appliances Division, 424; Council's annual report, 555; "Leading the World" publication, 562; Booklet of abbreviations, 568; Annual meeting, 608
British Electrical Development Association: Exhibitions on loan, by N. F. Phillips, 168; New newsletter, 175; Annual conference, 402, 785, 804; Electrical Housecraft Advisors' conference, 406; Scottish Dairy Show exhibit, 452; Public Speaking Competition, 526, 871, 1001; Annual meeting, 728; Booklet on film projection, 869; Annual report, 901; Annual luncheon, 947; Grain drying handbook, 950; Chelsea Flower Show exhibit, 955; Home freezing publication, 1020; "Electricity for the Grower" book, 1021
British Electrical Power Convention: Future of the, 112, 140; Programme, 186, 231, 646, 810, 971, 973; Golf competitions, 640; President's portrait, *facing* p. 972; Exhibition, 974; 1960 venue, 1019; Proceedings, 1029–1041, 1079, 1086–1091; Presidential address, 1032; Electrical Forum, 1107, 1155; Annual dinner, 1155
British-European trade, by N. A. H. Stacey, 212
British Exhibition, New York, 825
British Guiana: Nuclear power station project, 325, 484; Telephone system modernisation, 1066
British Hydromechanics Research Association open days, 1106
British Industrial Measuring and Control Apparatus Manufacturers' Association: Annual luncheon, 221
British Insulated Callender's Cables: New Cardiff branch, 267; Railway electrification film, 358; High-voltage laboratory, 407; Integration of Panelec with, 525; Cable for Edinburgh Royal Botanic Garden, 569; New Zealand cable installation, 1145
British Iron and Steel Institute: Translation service, 182
British Iron and Steel Research Association: Annual report, 994
British Lighting Council: New premises, 93, 103, 165; South Western Centre inaugural meeting, 343; Birmingham conference, 827; Recent activities, 911
British Non-Ferrous Metals Research Association, New laboratory of, 986
British Oxygen Co. v. South of Scotland Electricity Board, 529, 787
British Radio Valve Manufacturers' Association: Agreements ended, 641
British Refrigeration Association: Annual luncheon, 607; Annual report, 642
British Safety Council's seal of approval, 549, 592
British Scientific Instrument Research Association: Laboratories, 112; Test service, 402
British Sealed Beams: Formation of, 1019; Factory of, 1100
British Standard Specifications: Hospital vacuum cleaners, 81; Rotary switches, 171; Enamelled copper conductors, 171; Desk-type fans, 171; Glass-braided conductors, 189; Aircraft electrical equipment, 410; Aerial feeder cables and connectors, 434; Asbestos insulating paper, 461; Isolators, 561; Cable boxes, 561; Electrolytic capacitors, 634, 1141; Printed wiring dimensions, 678; Round wire copper conductors, 716; Refrigerators and food freezers, 818; Electronic valve bases, caps and holders, 850; Power transformers, 878; Insulating oil, 898; Enclosed fuseboards, 906; Aircraft invertors, 961; Flameproof motors, 987; Terminal markings, 1099; Gas and dual-fuel engines, 1106; Refrigeration compressors, 1122
British Standards Institution: Sheet, strip and wire sizes decisions, 162; Insulating oil maintenance Code of Practice, 692
British Tabulating Machine Co.: Training college kitchen installation, 268; Merger with Powers-Samas, 268
British Thomson-Houston Co.: Motor price reductions, 19; Recent orders, 358; New Zealand geothermal equipment contract, 566; Marine radar demonstration, 610; Works visit, 611; Developments in motor manufacture, 645; Booklet on selsyns, 790; Overseas graduates, 1100
British Trade Fair, Lisbon, 347, 526, 687
Brook Motors, New ambulance centre of, 315
Brookhirst Igranic: Sales conference, 452; Management changes, 912; European subsidiary, 954; Works visit, 1145
Brown Brothers, New Wolverhampton branch of, 222
Bruce Peebles–Simon-Carves agreement, 825
Budget, The, 678; —— and production costs, 709; Debate on, 723
Building costs, Electrical manufacturers and, by R. B. Hellard, 354
Building Plant Exhibition, 586
Building (Scotland) Bill, 403
Bulb water turbines, by Monsieur P. Danel, 38
Bulgaria, Trade agreement with, 522
Burrough, James, New gin distillery of, 687
Bylock Electric mobile display unit, 526

CABLE factory lighting installation, 451
Cable-making industry, Competition in the, 24
Cable repair ship, New, 911
Cable sheathing, Direct extrusion method of aluminium, 263
Cable system, Gas-filled, 12
Cables: Cook Strait scheme, 29; Aircraft —— contract, 165; New Zealand order, 222; Kariba scheme, 314; Fault in Atlantic telephone, 397, 438; Transatlantic telephone —— developments, 438, 489; Synthetic rubber insulated ship wiring, 451; Second transatlantic telephone, 553; Aircraft, 610; Commonwealth telephone —— project, 614, 980; —— for British Railways, 684; Scotland-Faroes-Iceland telephone —— project, 685; Price-fixing agreements to end, 685; Snowy Mountains 330 kV installation, 688; Indonesian order for, 728; Data booklet on copper, 788; Handbook on aluminium, 790; Self-supporting telephone, 826; Makers' assurance on prices, 912; Machine for laying heating, 1057; Rocket research, 1100; Hong Kong submarine telephone, 1101; New Zealand impregnated pressure —— installation, 1145
Calder Hall nuclear power station, The electrical installation at, by N. J. Mackay and E. Hardwick, 170
Cambridge Instrument Co.: Redesigned showrooms of, 166; New publications, 1102
Camera, Ultra-sound image, 353
Canada: Labrador water power scheme, by E. N. Webb, 16; Siemens Edison Swan extensions, 70; Valves for Bersimis power station, 119; Power progress in, 243; Selling electric fires in, 267; Nuclear power in, 330; 1958 power output, 369; Quebec Hydro-Electric Commission's new headquarters, 369; Peace River hydro-electric project, 566, 795; Shawinigan expansion, 595; Instruments for, 730; Exhibition train for, 826; Columbia-Kootenay development schemes, 907; Water power resources, 950; Radio-telephone equipment for, 956; Nuclear reactor experiment, 1061; St. Lawrence power project, 1104
Canopy space heaters installation, 268
Capacitors, Reliability of paper, by J. P. Pitts, 481
Caribonum, Supply change-over at works of, 640
Carron Company, Bicentenary of, 166, 1057
Cartridge fuse dispensers, 22, 569
Catering equipment exhibitions, 789, 912
Cathode ray tubes: Guarantee period, 957; Production of wide-angle type, 965
Census of Distribution, 68, 1102
Central Electricity Generating Board: Contracts placed, 28, 270, 314, 325, 528, 791, 1024, 1058; Plant installed in 1958..83; New plant commissioned, 232; Record power demand, 232; Film by, 325; Bristol offices, 369; Armorial bearings, 403; Berkeley nuclear research centre project, 484; Electronic calculator for, 526; Control engineers' course, 788; Nuclear power exhibition, 821; Stand at National Education and Careers Exhibition, 1019; Inspection by helicopter, 1060
Central Line tube: Report on train fire, 313, 334; Equipment for, 359
Ceylon, Atomic Energy Authority for, 907
Chapelcross nuclear power station: Control room lighting at, 66; First power from, 424, 454; Official opening of, 843, 845; Description of, 845
Chelsea Flower Show, 955; Automatic greenhouse exhibit, 972, 1013
Chick brooder, Heat storage type, 610
Chief Alkali Inspector, Annual report of, 1117
Chilean power station projects, 865
China, Trade with, 321, 723
Chinese hydro-electric project, by R. Westgate, 125
Chinese scientific literature, Collection of, 685
Church bell ringing installation, 357
CIBA (A.R.L.), New resins plant of, 1019
CIBA Fellowship Trust, 68
Cinema contest, 268
Clarence Dock power station smoke problem, 1104
Clayton, James, Lecture, by Monsieur P. Danel, 38
Clean air: Film on, 488; Chief Alkali Inspector's annual report, 1117
Cleaning unit for boiler flues, Mobile, 403
Clocks, Electric: Outdoor, 109; Exhibit at Electrical Engineers' Exhibition, 250; Smiths' 1959 range of, 314
Clothes dryers, Survey of spin and tumbler type, 650
Clyde tunnel project: Compressed air installation for, 348; Road heating for approaches to, 865
Coal: Use in power stations, 226; End of underground gasification tests, 250; Small —— in industry, by J. N. Williams, 313
Coal handling, Power station, by A. Szold, 95
Coal mining and electricity, by A. P. Foster, 562
Cobalt radiography equipment, 686
Colchester-Clacton line electrification, 723, 757
Cold storage plant: Large, 1015; Floor heating in a, 1102
Cole, E. K., Contractors' visit to works of, 956
College of Agricultural Engineering, Establishment of, 359
College of Technologists, 972
Columbia Theatre, Shaftesbury Avenue, 315
Combwich port, Plant for Hinkley Point shipped through, 454
Comité Européen des Constructeurs de Matériel Frigorifique, 268
Common Market: United Kingdom and —— tariffs, 462; Free trade discussions, 1126; News letter, 1144
Commonwealth, Opportunities in the, 1056, 1102
Commutator undercutting machines, Electronic, 788
Compass, Transmitting magnetic, 644

Competitions: Window display, 21, 825; Cinema, 268; Illuminated sign design, 359, 452; Essay, 439, 451; Public speaking, 526, 871, 1001; Industrial art bursaries, 541, 870; Street lighting column, 570; Hotpoint, 570; Hoover, 707; Electric car design, 721; Trade and technical literature, 730; Service Centre, 826, 955; Fondation George Montefiore, 1058; Durham Bursary, 1101
Competition among manufacturers, Forecast of increased, 1057
Comptroller-General of Patents, Designs and Trademarks, Annual report of, 1041
Computers, *see* Electronic computers
Concrete block factory, Floor warming installation in a, 1060
Conon Valley hydro-electric schemes, 746
Consumers, Protection of, 262, 1147
Contact materials, Electrical, by N. A. Tucker, 1127
Contract price adjustment formulæ, 163, 452, 609, 790, 954
Conveyor control systems, by T. P. Thomson, 629
Conway Castle floodlighting installation, 128
Cook Strait cable project, 29
Cookers: Allowances on old electric, 172; Sales promotion committee formed, 525; —— for blind persons, 565; Production at Belling & Co.'s works, 747
Cookery demonstration, 1057
Cooling tower, Future of the, by G. C. Parkinson, 476
Copper Development Association, New publication of, 1110
Corrosion probes in flue gases, 324
Corrosive atmospheres, Equipment in, 956
Council houses: Boldon, 128; Bexhill, 325; Maidstone, 325; Haltwhistle, 765; Easington, 864
Council of Industrial Design: "Designs of the Year" awards, 911, 1019
Courts, In the: Conspiracy charge fails, 314; Youths to pay compensation for damage to transmission line, 317; British Oxygen Co. v. South of Scotland Electricity Board, 529, 787
Crane-approach warning system, 22
Curie, Pierre, Centenary of birth of, 906
Czechoslovakia: Exchange of power with Austria, 271; Steelworks inspection equipment for, 571; British trade agreement, 686

DATA Processing, 70
Demonstration units, Mobile, 69, 316, 869
Denmark: Nuclear reactor project, 346
Department of Scientific and Industrial Research: National lending library project, 74; Translations Bulletin, 156; Grants, 324; Atmospheric pollution investigation report, 482; Chinese scientific literature collection, 685; Research Council's annual report, 961
Department store electrical installation, 472, 473
"Designs of the Year" awards, 911, 1019
Dexion exhibition, 1058
Diesel alternators installation, Automatic start, 934
Diesel Engineers' and Users' Association, Annual report of, 104; Annual luncheon, 769
Diesel engines: Large thermo-siphon cooled, 120; Medium speed, 434
Dimplex sales conference, 790
Diplomas in Technology, 800
Display unit, Mobile, 526
Distillery, New, 687
Distribution networks, Remote control of, by L. J. Day, 140, 141
Docks modernisation schemes, 611
Domestic appliances in the doldrums, by V. P. Marciandi, 193
Domestic electrical equipment: G.E.C. design centre, 118; —— and load factor, 155; Electricity Boards' sales of, 172, 369, 565, 746, 821, 907, 1024, 1061; Approvals scheme, 226; Manufacture of —— at English Electric Co.'s works, 340; Television programme on repairs to, 549; 1958 imports of, 571; "Try it Yourself" exhibition of, 609; Advertising of second-hand, 614; Increase in sales of, 1147
Domestic electrical equipment surveys: Immersion heaters, 32; Washing machines, 272, 359; Wash boilers, 456; Spin and tumbler dryers, 650; Refrigerators, 832; Irons, 1070
Domestic electricity consumption, 380
Domestic Equipment Fair, 121
Dominican Republic hydro-electric scheme, 271, 950
Drakelow "C" power station project, 820
Dry shavers, Consumers' Association report on, 219
Dubilier Condenser Co., Factory extension of, 1022
Dudley supply change-over, Completion of, 701
Dungeness lighthouse, Experimental discharge lamp for, 527
Du Pont Co., Research and testing laboratory of, 905
Dynamic braking of a.c. motors, by S. A. Choudhury, 756, 760

EAST Midlands Electricity Board: Tariff changes, 82; Inspection of consumers' installations, 565; Reinforcement schemes, 1162
Eastern Electricity Board: Stevenage Service Centre opened, 128; Damage by birds to power lines, 151; Hornchurch substation, 325; Off-peak rates, 413, 454, 565; Cookers for the blind, 565; Finchley change-over completed, 565; Boarding house tariffs, 907
Economic Survey 1959..696
Eddystone Lighthouse, New optic for, 368
Edinburgh Ideal Home Exhibition, 1103
Edinburgh Royal Botanic Garden, Cable for, 569
Education: UNESCO survey of technical, 67; High technology courses, 121; Technical —— journal, 269; Technical, 423, 759; Report of Advisory Committee on Further —— for Commerce, 609; Teaching of electrical engineering, by A. T. Craven, 665, 672; Capital investment for technical, 759; Grants to students, 844; Technical —— in Germany, 1016
Education and Careers Exhibition, 1052
Egypt: Aswan High Dam agreement, 29
Ekco Electronics works visit, 406
Ekco Plastics, Russian delegation's visit to, 729
Elastomer research and testing laboratory, 905
Electric Cable Makers' Federation annual meeting, 450
Electric cars: Design competition, 721; "Retirement" of a veteran, 870
Electric drives in the paper industry, by P. D. House, 562
Electric floor heating practice, by R. D. Jackson: IV—Economic and basic design considerations, 8; V—Alternative types of system, 55
Electric lamp, Sir Joseph Swan and the development of the, by Dr. J. N. Aldington, 444
Electric Light Fittings Association, Annual luncheon of, 741
Electric power equipment, O.E.E.C. survey of, 295
Electric refrigerators, by D. C. Billing, 929
Electric shock, Resuscitation from, 48
Electric Vehicle Association, Annual report of, 902
Electric vehicle magazine, 405
Electric vehicle service depot, 955
Electrical Association for Women: Annual conference, 241, 812; Vera Norvick memorial fund, 346; Examinations awards, 360; Electrical Housecraft Advisers' conference, 406; Lancashire Branch anniversary, 590; *Electrical Age* re-styled, 686; Activities, 686, 1021; Area conferences, 789; Power Convention luncheon, 1107
Electrical contact materials, by N. A. Tucker, 1127
Electrical contracting industry: Outlook for, 333; Non-registration of an apprentice, 825
Electrical Contractors' Association: Annual dinner, 365; Essex Branch annual dinner, 395; Liverpool Branch annual dinner, 586; North Worcestershire and Staffordshire Branch annual dinner, 590; Annual Conference, 612, 1126, 1132; Bradford Branch annual dinner, 769
Electrical contractors' liability in unsafe premises, by F. E. Sugden, 442
Electrical engineering: New methods, materials and techniques in, by H. G. Taylor, 588; Teaching of, by A. T. Craven, 672
Electrical Engineers Exhibition, 67, 224, 250, 368, 398, 471, 580; Stand-by-stand preview, 490–522; Opening ceremony, 547; Survey of, 600–607; Attendance figures, 642, 788; Industrial equipment award, 853; Exhibitors' meeting, 911
Electrical engineers, Recruitment of professional, by K. L. Stretch, 1093
Electrical films at Harrogate, by A. M. Hughes, 854
Electrical Floor Warming Association, Formation of, 290, 310
Electrical goods, World trade in, 196
Electrical Housecraft Advisers' conference, 406
Electrical Industries Club, Annual general meeting of, 723; June luncheon, 1152
Electrical industry: Economic and technical developments in 1958..199; Leadership in the, 537
Electrical insulation faults, by H. F. Church, 290, 291
Electrical manufacturers and building costs, by R. B. Hellard, 354
Electrical manufacturing statistics, B.O.T., 886, 921
Electrical safety regulations, 567
Electrical Sign Manufacturers' Association: Design competition, 359, 452
Electrical Trades' Commercial Travellers' Association: Annual luncheon, 419; Midlands Branch ladies' evening, 637
Electrical Trades Union: Employment situation reports, 266; Annual delegate conference, 359, 1044, 1142; Ballot inquiry, 406; Correspondence with T.U.C., 635; "Secret trial" by, 666; Expenditure questioned, 912; Annual financial statement, 1019; Wage claim, 1102
Electrical Wholesalers' Federation: Change of address, 222; Annual dinner, 247, 580, 594; Annual general meeting, 638
Electrical windings, Aluminium foil and strip for, by J. J. Lee, 667, 826
Electricity Board for Northern Ireland: Borrowing Powers Bill, 864
Electricity Boards: Staff on the, 2; Sales of domestic appliances, 172, 369, 565, 746, 821, 907, 1024, 1061; Rating assessments, 226
Electricity Boards' sales: November, 1958..28; December, 1958..232; January, 413; February, 613; March, 820; April, 1060
Electricity (Borrowing Powers) Bill, 186, 220, 261, 347, 380, 397, 489, 567, 614, 656
Electricity Consultative Councils, by F. Kenyon, 1006
Electricity consumption, Domestic, 380
Electricity Council: Area Boards' domestic appliance sales, 172, 369, 565, 746, 821, 907, 1024, 1061
Electricity expansion, Financing, by D. J. Bolton, 995
Electricity in Europe: O.E.E.C. publication on price of, 166; O.E.E.C. report on, 688
Electricity in industry, by P. W. R. Gatliff, 981
Electricity supply and demand, 1027
Electricity supply industry: Wages, 48, 163, 728; Organisation chart, *facing* p. 150; Borrowing Powers Bill, 186, 220, 261, 347, 380, 397, 489, 567, 614, 656; 1958 developments, 202; Weir Committee's report, 624, 633, 635, 656; Joint consultation, 666; 1959–60 capital expenditure, 710, 720; Training scheme for commercial engineers, 1008; Longer holidays request, 1019; "Priority one," by A. N. Irens, 1036, 1087; Conference, 1064
Electroflo Meters Co. training school, 527
Electro-heat, International congress on, 299, 1105, 1158
Electrolux, Redesigned London showroom of, 358
Electrolytic conductivity cells, 791
Electron microscope chart, 465
Electronic computers: I.C.I. order for, 164; Buenos Aires University, 406; Liverpool University, 609; Australian order for, 826; Film on, 1000; Small digital, 1021; Symposium on instrumentation and computation, 1051; Order for Pegasus, 1146
Electronic control in industry, 462
Electronic counting techniques, by C. C. H. Washtell, 539
Electronic equipment: Discussion on maintenance of, 803; —— of airfields, by E. H. Bruce-Clayton, 881; Exhibition of, 405, 913
Electronics in the plastics industry, by P. E. Merry, 693

Electronics in the railway industry, by B. K. Cooper, 335
Electronics in the textile industries, by W. E. Swale, 625
Elm Engineering, Production of welded aluminium tube by, 533
Embargo list amendments, 68
Employment situation, 94
Energy balance in feed systems, Method of comparing, 312
Energy, Transport of, 927, 1022
Engineering careers, Booklet on, 1141
Engineering Centre, Birmingham, New class of membership of, 420
Engineering, I.E.E. discussion on women in, 697
Engineering in Europe, 54, 110, 147, 647, 784, 876, 959, 1075, 1092
Engineering, Marine, Welding and Nuclear Energy Exhibition, 732–741, 778
Engineering standards conference, 878, 1091
Engineering unions' shorter week claim, 380, 403
Engineers and scientists, Shortage of trained, 423
Engineers' Guild: Annual report of, 111; Appointments service, 871
English Electric Co.: New subsidiary, 119; Water valves for Canada, 119; Turbo-alternators for High Marnham, 119; Valve exhibition, 121; Rejected tender for American dam project, 163, 186, 231, 244, 262; Sennar Dam project, 165, 359, 643; Snake River tender, 244; New service centre, 267, 685; Refrigerator film, 268; South African contract, 271; Automatic rolling mill demonstration unit, 316, 869; Liverpool domestic appliances works of, 340; Indian factory opened, 360; Circuit-breakers for Venezuela, 404; Scholarships, 450; Valve data brochure, 451; Works visit, 452; Transformers for India, 453; Computer for Liverpool University, 609; Tenders for American power projects, 685, 911; Agreement with North American Aviation, 1059
Estate supply terms, Objection to, 864
Euratom agreement, 226, 290, 312
Europe: O.E.E.C. publication on price of electricity in, 166; British trade with, by N. A. H. Stacey, 212; O.E.E.C. survey of electric power equipment in, 295; Common Market, 334; O.E.E.C. report on electricity supply in, 688; Negotiations with, 778
European Free Trade: Documents on, 303; Parliamentary debate on, 347
Exhibition train for Canada, 826
Exhibitions: All-Electric Housing, 730; British Electrical Power Convention, 974; Building Plant, 586; Catering equipment, 789, 912; Chelsea Flower Show, 955; Dexion, 1058; Domestic Equipment Fair, 121; Edinburgh Ideal Home, 1103; Education and Careers, 1052; Electrical Engineers, 67, 224, 250, 368, 398, 471, 490–522, 547, 580, 600–607, 642, 788, 853, 911; Electronic equipment, 405, 913; Engineering, Marine, Welding and Nuclear Energy, 732, 778; Factory Equipment, 136, 743; Hanover Fair, 896; Ideal Home, 440; Industrial Arts Bursaries, 870; Instrument, 239, 241, 316, 730; International Plastics, 554, 1092, 1125, 1135; International Samples Fairs, 729, 1103; International Transistor, 938, 1010; Lighting equipment, 222; Lisbon Trade Fair, 347, 526, 687; Measuring equipment, 239; Mechanical Handling, 405; Mining Machinery, 164; National Education and Careers, 1019; New York British, 825; Nickel alloys, 869, 955; Nuclear power, 821; Physical Society, 139, 159; Pneumatics and Hydraulics, 790; Printed circuit, 729; "Quick Freeze," 120; Radio and Electronic Components, 624, 689; Rand Easter Show, 260; Refrigeration equipment, 314, 827; Schoolboys', 69; Scottish Dairy Show, 452; Scottish Industries, 450; "Stelvetite," 22; Swiss Import, 451; "Try it Yourself," 609; Wholesalers' jubilee, 727; Willesden Technical College, 267
Exhibitions on loan, by N. F. Phillips, 168
Exhibitions, Reflections on, 710
Expansion of Britain's economy, Directions of, 666
Export: Prospects, 163; Problems and opportunities, 185; —— competition—a new phase?, by H. G. Nelson, 187; Untapped —— opportunities, by D. G. W. Acworth, 190; 1958 background to, 199; Licensing control changes, 316; Volume index for electrical, 358, 1059; Nuclear power, 623, 656; "Survey of —— Trade Facilities," 744; Electrical ——s and imports, 776
Export Credits Guarantee Department, Extension of facilities by, 871
Exporting to the Middle East, by W. H. McFadzean, 210

FACTORY Equipment Exhibition, 136, 743
Factory installations, by A. A. Clery, 3
Faraday Lecture, London presentation of, 254
Faraday Memorial, Proposed, 444
Farm electrification: Course on, 870; Progress of, 928
Faulty tools, Injury by, by F. E. Sugden, 1122
Faulty wiring and the law, by F. E. Sugden, 76
Federation of British Industries: Director-General's statement on "convertibility," 16; Budget representations, 221; Inquiry into industrial trends, 334; Annual report, 641; "Survey of Export Trade Facilities," 744
Feed systems, Method of comparing energy balance in, 312
Fenner, J. H., & Co.: Formation of Australian company, 1020
Ferranti: Transformers for U.S.A., 20; Agreement with Raytheon Corporation, 221; "Sirius" computer, 1021; Transformer noise testing chamber, 1100; Computer order, 1146
Festiniog Railway, 807
Film projectors, Novel use of, 1145
Filmlet viewer, 269
Films, Industrial: Niagara floodlights, 183; Refrigerator, 268; Crompton Parkinson, 315; Electricity supply, 325; Railway electrification, 358; C.O.I. catalogue of, 451; Clean air, 488, 611; Harrogate Festival, 568; Awards, 643; Associated Electrical Industries, 683; Electrical —— at Harrogate, by A. M. Hughes, 854; "Your Film Show" booklet, 869; Computer, 1000; International Congress, 1102
Financing electricity expansion, by D. J. Bolton, 995
Finchley supply change-over completed, 565
Finland, Multi-channel radio telephone link for, 1103
First aid boxes in factories, New regulations on, 1100
Floodlighting installations: Castle, 128; Football ground, 163, 863; Film of Niagara, 183; Pedestrian crossings, 790; London buildings, 864; Railway bridge, 955; Crewe railway yards, 962
Floor heating: Electric —— practice, by R. D. Jackson, 8, 55; Installations, 29, 59, 172, 701, 950, 956, 1060, 1102; Demonstration of ceiling and, 165; —— system maintenance, by L. Arkinstall, 251; Tariffs, 270; Manufacturers' association formed, 290, 310; Off-peak, by H. H. Bruce, 523; Method for existing floors, 624, 646; Traffic ramps installation, 643; Zoo installation, 956; Cold store installation, 1102; —— in flats, 1162
Floor warming system maintenance—fault location on solidly embedded installations, by L. Arkinstall, 251
Fluorescent fittings, New range of, 122
Folkestone power station, Closure of, 648
Food-mixer design, 956
Football ground floodlighting installations, 163, 863
Football pitch soil-warming installation, 172
"Formica Industrial Journal," 643
Foundry, Closure of a, 729
France: 1957 electrical trade of, 89; Electricity supply, 1958–59..390; Nuclear power in, 865
Free trade discussions, 1126
French atomic pioneers, 906
Frozen food store installation, 957
Fuel and power policy, 321, 886, 910, 1009
Fuel contaminants, 94
Fuel efficiency loan scheme, 226
Fuels, Boiler, 48
Fundamental theory, Teaching, 665
Furnaces, Electric: American order for, 119; Steel coil annealing, 315; Contract for annealing, 360; Transformer laminations heat treatment, 522; Manufacturers' agreement, 912; Large South African, 1012
Fuses: Discrimination between h.r.c., by E. Jacks, 367; ASTA tests for, 800, 810; Automobile, 928

GAS-ELECTRICITY co-operation, Weir Committee's report on, 624, 633, 635, 656
Gas turbine alternator, 800, 811
General Electric Co.: Appliance Design Centre, 118; *Export Guide*, 163, 788; Fluorescent fittings trade terms, 165; Film of Niagara floodlights, 183; Contracts obtained, 221, 450, 525, 569, 609, 729, 825, 957, 1058; Japanese nuclear power station design, 397; New lighting fittings, 561; New subsidiary, 728; New Irish company formed, 831; Ealing distribution area office, 953; German nuclear power agreement, 1001, 1056
Generation in Great Britain, 988–994
Generation of electricity: Scottish Boards' November, 1958, figures, 28; Geothermal, 47; Steam stations output, 82; December, 1958..773; January, 413; February, 613; March, 820; April, 1024; May, 1958 figures, 173; New plant commissioned, 232; Scottish Boards' 1958 figures, 232; —— from process steam, 861; —— in Great Britain, 988; Date for parity of prices of "nuclear" and "conventional," 1107
Geo-electric surveys, Prof. L. S. Palmer, 300
Geothermal power generation, 47
Germanium rectifier manufacture, 445
Germany, East: Trade with, 221
Germany, West: Kenwood subsidiary in, 222; Nuclear power station project, 455, 472; Linear accelerator for, 595; Plessey subsidiary in, 870; Hanover Fair, 896; Technical education in, 1016; British educationists' visit to, 1016
Ghana: Mssion to, 260; Radio link equipment for, 405; Volta River project, 756, 795; University lighting fittings order, 913
Gibb, Sir Claude, Death of, 155
Gift of tongues, The, by D. Maxwell Buist, 1097
Gin distillery, New, 687
Gladstone Dock (Liverpool) radar installation, 266
Glasgow Smoke Control Order, 820
Glass Manufacturers' Federation, 163
Gloster Aircraft Co.: Technical Developments Division taken over, 1101
Gold mine, Winding equipment for a, 450
Goodall, S. E., Portrait of, *facing* p. 334
Grain drying handbook, 950
Greenhouse, Electrically equipped automatic, 972, 1013
Greer's Ferry Dam project: Rejection of British tender, 163, 186, 231, 244, 262
Grid in evolution, The, 579
Grid, Multi-purpose construction, 790
Griffin & George (Research & Development), Formation of, 268
Guernsey: Generating plant for, 686; Electricity Board's annual report, 795
Guildhall lighting installation, 267

HACKBRIDGE & Hewittic Electric Co., Germanium rectifier manufacture at works of, 445
Hackbridge Cable Co., Aluminium cable sheathing method developed by, 263
Hampshire Refrigeration, New headquarters of, 570
Hanover Fair, 896
Hardboard manufacturing plant, New, 920
Harrogate industrial film festival, 568; Electrical films at, by A. M. Hughes, 854
Hartland Point lighthouse mains supply, 172
Harwell Reactor School course, 162
Hawker Siddeley Group: Reorganisation, 267; New turbine company, 1101
Heat treatment service, 611
Heating (*see also* Floor heating): Road —— installations, 262, 369, 701, 865; Canopy space —— installation, 268; Traffic ramps installation, 643; Swedish district — scheme, 746; Tunnel approaches, 865
Heating cable, Machine for laying, 1057
Heating plant, Nylon setting, 69
Heavy engineering shop, New, 801
Heavy-oil burning, by Dr. J. S. Clarke and G. J. Hudson, 264
Helicopters: Power station inspection by, 1060; Pole erection by, 1162

Hellermann "News Sheet," 730
Henley's, W. T., Telegraph Works Co., New Indian company of, 1056
High Marnham power station: Equipment for, 119, 1102; First turbo-alternator set tested, 781
High voltage indicator for railways, 92
Hinkley Point nuclear power station project, Progress of, 201, 454, 1104; Goliath crane at, 1162
Hire-purchase: Wholesalers' service, 222; South of Scotland Electricity Board's new terms, 232; Capital, 347
Holland, Diesel generators for, 269
Hollerith-Powers-Samas merger, 268
Hong Kong: North Point "B" power station opened, 16, 82; Telephone cable for, 1101
Hoover: Factory developments, 570; Careers booklet, 611; Sales contest, 707
Hospital electrical installations, by J. W. J. Leslie, 389
Hospital heating dispute, 844
Housing standards, Committee on, 538
H.r.c. fuses, Discrimination between, by E. Jacks, 367
Hunter Memorial Lecture, by C. O. Boyse, 112
Hunterston nuclear power station project, Progress of, 201, 430; Strikes at, 526, 568
Hydraulic laboratory, Italian, 671
Hydraulic research, 1147
Hydraulic turbine in evolution, by Monsieur P. Danel, 38
Hydro-electric power stations, Underground, by B. K. R. Prasad, 77

ICE factory electrical equipment, 165
Ideal Home Exhibition, 440
Illuminating Engineering Society: Birmingham lighting equipment display, 222; Golden jubilee banquet, 302, 344; Liverpool Centre annual luncheon, 435, 487; Golden jubilee celebrations, 768, 912, 1050
Immersion heaters, Survey of, 32
Imperial Chemical Industries, Silicon manufacture by, 366; Plastics Division mobile showroom, 569
Imperial College telephone exchange installation, 957
Imports: Chart of world electrical, *facing* p. 196; 1958 electrical, 265; Volume index for electrical, 358; Electrical —— and exports, 776; Dollar —— freed, 1056
Incorporated Plant Engineers, Change of name of, 223
Incorporated Sales Managers' Association: Training courses, 120
India: Transformer manufacture in, 104; News from, 124; Formation of ACC-Vickers-Babcock, 221; Electrical trade of, 286; Equipment for steelworks, 314, 1146; Aluminium conductor manufacture in, 316; English Electric factory opened, 360; Transformers for, 453, 954; Conference on power development in, 566; Silicon rectifier for, 569; New cable company, 1056
Indonesia, Cables for, 728
Industrial designs, Committee on protection of, 958
Industrial interdependence, 1125
Industrial outlook, Brighter, 1147
Industrial pH measurement and control, by R. S. Evans, 1114
Industrial Safety Association, Formation of, 316
Industry and the House, by A. M. F. Palmer, 261, 439, 593, 817, 1009
Information engineering, M.Sc. course in, 368
Infra-red nylon setting plant, 68
Injection moulding machine, Large, 467
Injury by faulty tools, by F. E. Sugden, 1122
Installation engineering, by C. C. Hyams, 1028, 1038, 1090
Installation inspection, by E. J. Sutton, 1039, 1090
Institution of Electrical Engineers: Benevolent Fund, 17; London meetings programme, 175; East Anglian Sub-Centre dinner-dance, 214; Transistor convention, 299, 938, 1010, 1045; South Midland Centre annual dinner, 305; Radio and Telecommunication Section renamed, 313; Convention on long-distance waveguide transmission, 364; South-Western Sub-Centre annual dinner, 395; East Midlands Centre annual dinner-dance, 395; Annual dinner, 443; Supply Section annual dinner-dance, 551; North-Western Centre annual dinner, 552; Merseyside and North Wales Centre annual dinner-dance, 591; Scottish Centre annual dinner, 592; Proposed by-law changes, 636, 722; Discussion on women in engineering, 697, 721; Special meeting, 722; North Midlands Centre annual dinner-dance, 724; Southern Centre annual dinner-dance, 769; Western Centre annual dinner-dance, 823; Annual report, 824, 904; Convention on thermonuclear processes, 851; Supply Section annual lecture, 1012; Wiring Regulations interpretations, 1099; Summer Meeting, 1134; Elections, 1152
Institution of Mechanical Engineers: New journal, 12
Institution of Plant Engineers, 223, 396, 562
Instrument exhibitions, 239, 241, 730
Instrument test service, 402
Instrumentation and computation, Symposium on, 1051
Instruments, Inadequate servicing manuals for, 799
Insulation faults, Electrical, by H. F. Church, 290, 291
Insulation, Plastics for, 425
Insulator companies' amalgamation plans, 592
International Combustion, New heavy engineering shop of, 801
International Computers & Tabulators, Formation of, 268
International Congress and Exhibition for Instrumentation and Automation: 1960 venue, 696
International Congress on Electro-Heat, 299, 1105, 1158
International Convention on Transistors, 299, 938, 1010; Review of papers, by I. G. Cressell, 1045
International Geophysical year: Booklet on achievements of, 198; Kelvin Lecture on the, by Sir David Brunt, 814
International Instrument Show, 316
International Labour Conference, 1146
International Plastics Exhibition, 554, 1092, 1125, 1135; Convention, 1140
International Samples Fair: Milan, 729; Barcelona, 1103
International Scientific Film Association, Congress of, 1102
International Transistor Exhibition, 938
Invertor, Static power, 643
Iran, Radiotelephone equipment for, 730
Ireland, Republic of: Research reactor decision, 566; River Clady hydro-electric station, 614; New G.E.C. company, 831; Supply Board's plans, 1060
Irons, Survey of domestic electric, 1070
Italy: Niguarda hydraulic laboratory, 671; Plant for nuclear power station, 1056

JAMES Clayton Lecture, by Monsieur P. Danel, 38
Japan: Nuclear power station project, 307, 397, 424, 455, 612, 641, 666, 684, 715
Jessop, William, & Sons, Zirconium production by, 81
Jones, Edwin, Electrical installation at Southampton store of, 473
Jordan: Radar equipment for, 525; Telephone equipment for, 568
Junior Institution of Engineers' bursary competition, 1101

KARIBA hydro-electric scheme, Plant for, 314, 358, 452, 865
Kayser Ellison & Co., Modernisation of steel plant of, 419
Kelvin Lecture, by Sir David Brunt, 814
Kenwood Manufacturing Co.: West German branch of, 222; New office extension, 912; Australian and New Zealand companies, 1059
Kettle, H. E.: Hire-purchase service, 222; Bromley branch extension, 222
Kincardine power station: First set commissioned, 28; Contracts for completion of, 614, 648; Description of, 887
King, C. R., Portrait of, *facing* p. 972
Kitchen installations: Training college, 268; Restaurant, 409
Kitchen planning, 1080, 1102
Klydonograph for recording switching surges, by M. M. Khalifa, 157
Klystrons, wave tubes and resonators, Papers on, 410
Kuwait, Lamp-making machinery for, 70

LABORATORIES: British Railways, 74; S.I.R.A., 112; Equipment for subcritical, 405; B.I.C.C. high-voltage, 407; Atomic research, 484; Italian hydraulic, 671; Mullard, 831; Du Pont Co.'s, 905; Non-ferrous metals, 986
Labrador water power scheme, by E. N. Webb, 16
Laminated tubes, Range of, 1146
Lamp-making machinery for Kuwait, 70
Lamps: Price changes, 266, 317, 527; Manufacture in New Zealand, 404; Experimental atomic, 570
Lancashire Dynamo & Crypto: Motor price reductions, 19
Lancashire Dynamo Group sales conference, 405
Languages, Need for engineers to learn, by D. Maxwell Buist, 1097
Lead Development Association, Publication by, 69
Lec Refrigeration aircraft crash, 910

Letters to the Editor—
Advertisement symbols, by C. A. F. Fuller-Shapcott, 677
Alternators, Brushless, by F. J. Allen, 862
An architect's approach to floor warming, by W. H. Tibbs, 17
Automobile electrical equipment, by D. Foyle, 398
Beauharnois hydro-electric project, Size of, by S. E. Gieszczykiewicz, 437
Brushless alternators, by F. J. Allen, 862
Building construction and space heating, by G. Lomax, 75, 218; by R. I. Ellarby, 111
Car electrical systems, by "Stranded," 350
Closing the loop, by E. G. Semler, 17
Cows, Contented, by D. M. Cathcart, 75
Electric runabout's scope, The, by R. D. Reynolds, 949; by S. C. Macdonald, 1065
Electrical equipment maintenance, by F. R. Stanley, 218
Electrical manufacturers and building costs, by J. Mortimer Hawkins, 398, 554; by R. B. Hellard, 484
Factory clock systems, by F. Stevens, 111
Floor warming, Industrial, by T. Duffy, 156
Fusing, Single- or double-pole, by "Category III," 264
Industrial safety standards, by Parmelee (G.B.), 398
I.T.V. programme, Protest against, by J. Holder, 595
Pie carts and hydatids, by I. M. Page, 111
Post-graduate research, by "Graduate Engineer," 949
Question of size, A, by S. E. Gieszczykiewicz, 437
Secondary battery improvements, by M. Barak, 677
Service connections, by "Switch-On," 350; by "Meter Inspector," 350
Servicing manuals, Inadequate, by "E.G.," 862
Socket outlets, More, by E. H. W. Banner, 1065
Socket outlets, 13 A, by C. A. Cameron Brown, 218; by R. H. Robinson, 264; by G. Millett, 313; by "Disgruntled," 313; by W. E. Sage, 350; by M. V. Ferrier, 350; by S. Johnson, 437, 780; by D. B. Salter, 437; by S. M. Harris, 484; by R. C. K. Money, 554; by G. F. Loebl, 813
System harmonics, by R. J. Kayser, 636
Teaching of electrical engineering, by J. H. Gridley, 813; by A. T. Craven, 949
Thermo-nuclear power, by B. Wood, 264
Washer, Tests on a, by J. Leicester, 75
Wholesaler's plea, A., by W. Lowy, 437
Wholesaling, Competition in, by "Customer," 678
Level control equipment agreement, 1057
Libraries for industry and commerce, 611
Lifts, Electronic system of speed control of, by D. M. C. Dick and D. Embrey, 244, 245
Lighthouses: Mains supply to a, 172; New optic for a, 368; Experimental discharge lamp at a, 527
Lighting: Chapelcross power station control room, 66; —— load, 93; New trading terms, 121; New fluorescent fittings range, 122; Birmingham ring road, 174; —— equipment display, 222; Guildhall installation, 267; Industrial fittings catalogue, 269; M.O.T. survey of street, 321;

New fittings, 403; Cable factory installation, 451; Street —— conference, 453; New range of fittings, 561; Street —— column competition, 570; Need for street —— uniformity, 656; Improved Underground station, 701; Hendon street —— installation, 751; Examples of planned, 782, 870; Manufacturers' new research building, 856; Main traffic roads experimental installation, 864; Ghana University, 913; —— and architecture, by J. M. Waldram, 936; Crewe railway yards installation, 962; —— and the common weal, by O. W. Humphreys, 1041
Linear accelerator, German order for, 595
Liquid fuel firing, Conference on, 941

Liquidations—
Barnard & Buecheler, 43
Bradleys (Swinton), 285
Champion Electric Sales (Export), 328
Coleman, F. J. (Electrical Contractors), 620
Collins, Willie E., Holdings, 751
Deakins (Electricians), 620, 831
Dixon, R. G. (Worthing), 285
Dyne, E., & Co., 375
Easipower, 620
Electrical Supplies Co. (Manchester), 328
Electrocraft, 831
Electronic Distributors, 1154
Electronic Distributors (Exeter), 1154
Electronic Techniques, 533
Evergreens (Leicester), 831
Gem Radio (Kilburn), 180
Hayter, F. E., & Co., 467
Helikon, 917, 968
Hunt, Blackman & Co., 875
Liss Accumulators, 875
London Battery & Cable Co., 776
Morris & Smiles, 831
Northern Electrical Servicing Co. (Darlington), 1005
President Electrical Appliances, 1005
Radio & Electrical Mantel Co., 328
Refrigerator and Electric Appliance, 1113, 1154
Reliance Electrical Wire Co., 239
Russell, A. (Electrical), 180
Smith, E. & W. (Electrical Engineers), 135
Sudan Light and Power Co., 776
Tom Hall of Kettering, 375
Truvox Holdings, 467, 533
Veritys, 875
Wad Medani Light & Power Co., 776

Lisbon Trade Fair, 347, 526, 687
Liverpool: Port radar installation, 266; Pumping machinery for waterworks, 525
Liverpool University, Computer for, 609
Lloyd's Register of Shipping annual report, 557
Load factor: Domestic appliances and, 155; Improvement, 489
Loch Awe hydro-electric scheme, 472, 656, 958
Loch Glashan hydro-electric project, 701
Loch Loyal wiring installation, 451
Loch Shin hydro-electric scheme, 270
Locomotives: British Railways, 20, 206, 250, 406, 452, 462, 525, 789, 805, 924, 954, 1145; Sudanese contract for, 316; Metre gauge diesel-electric, 352; Diesel-electric —— for Argentina, 360; Defence of diesel —— policy, 462; South African manufacture of diesel-electric, 643; Tests on an electrogyro, by T. E. Green and J. K. Gessler, 714; Electric —— for South Africa, 728, 1020; Peak Class diesel-electric, 805; Southern Region electric, 924; Power units for shunting, 1021
London Electric Wire Co. & Smiths: A.E.I. offer for, 2; Sales conference, 1146
London Electricity Board: Booklet on training facilities, 119; Statistics folder, 172; Company charged with defrauding the, 314; Refrigerator hire-purchase terms, 565; Restricted-hour tariffs, 648; Report on transactions with Maybridge Construction Co., 779; Window display competition award, 825; Commercial tariffs, 1024

MAGNET, Large synchrotron, 913
Malaya: Cameron Highlands hydro-electric project, 43; Plant for, 164; Electrical imports of, 575; Central Electricity Board's annual report, 904
Maldive Islands, Radio station equipment for, 610
Manama "B" gas turbine power station, 1095
Manufacturing activity, Measuring, 886
Marconi Instruments' exhibition, 239
Martonair sales conference, 165
Materials Data, Services offered by, 642
Materials for the electrical industry, Annual review of, 71
Materials handling, Lectures on, 1024
Mauritius: Plan to harness tidal forces, 566
Maybridge Construction Co., Conspiracy charge fails against, 314; Report on London Electricity Board's transactions with, 779
Measurement research, American, 461
Mechanical Handling Exhibition: 1960 arrangements, 405
Mersey dredger equipment, Orders for, 569, 825
Merseyside and North Wales Electricity Board: 1958–59 progress, 82, 701; "Quick Freeze" exhibition, 120; Refrigeration exhibition, 314; Farm electrification course, 870
Metals: Prices list, 527; Booklet on nuclear, 644; Vacuum-melting technique for, 877
Meter testing, Responsibility for, 270
Meters: Economic service period for, by L. B. S. Golds, 479; Repeater type for flats, 795
Meters (Periods of Certification) Order, 1959.. 450
Metropolitan-Vickers Electrical Co.: Motor price reductions, 19; Electron microscope chart, 465; Linear accelerator for Germany, 595; Boiling plate display unit, 826
Mexico, Power supply in, 950
Middle East, Exporting to the, by W. H. McFadzean, 210
Midland Silicones sales conference, 1059
Midlands Electricity Board: Tariff change, 613; Dudley change-over completed, 701; Districts merged, 795; Leek rural area schemes delay, 1162
Milford Haven, Cable laid across, 648
Mine shaft signalling indicator, Luminous, 405
Mine winders, Contracts for large, 450, 525, 609, 729
Mining Machinery Exhibition, 164
Modern Cooking Promotional Committee, Formation of, 525
Monopolies Commission, Annual report on, 453
Morphy-Richards works visit, 360
Motor car, Model of electrochemical powered, 410
Motor manufacture, Developments in, 645
Motors: A long-service, 731; Dynamic braking of a.c., by S. A. Choudhury, 756, 760; Traction type for Rhodesia, 790; American order for, 1101
Moving pavement, Bank Station, 612
Mullard: New laboratories for, 831; Semiconductor factory expansion, 855

NATIONAL Certificate Procedures, Report of Working Party on, 70
National Coal Board: Luminous shaft indicators for, 405; Winder equipment for, 525, 609, 729; Annual report, 1065
National College of Agricultural Engineering, Establishment of, 359
National Council for Technological Awards, Report of, 800
National Education and Careers Exhibition, 1019
National Fire Protection Conference, 1144
National Industrial Safety Conference, 913
National Inspection Council for Electrical Installation Contracting: Southampton meeting, 266, 360; Progress report, 300; Invitation to local authorities, 380; Bristol meeting, 568; Roll of Approved Contractors, 1145
National Physical Laboratory: Annual report, 1014; Open days, 1028, 1049
National Power Farming Conference, 223
National Schoolboys' Own Exhibition, 69
National scientific library project, 74
National Society for Clean Air, 310
Nationalised industries, Finances of, 776
Natural gas, Power station operating on, 1095
Navigational aids, Parliamentary questions on, 348, 567
"Nescoe" reunion dinner, 596

New Books—
Aircraft Electrical Engineering, edited by G. G. Wakefield, 1120
An Introduction to the Theory and Practice of Semiconductors, by A. A. Shepherd, 102

New Books—*continued*
A.S.E.E. Year Book, 729
Basic Electrical Engineering, by J. Shepherd, A. H. Morton and L. F. Spence, 148
British Engineers' Association Handbook, 1101
British Instruments Directory and Buyers' Guide, 728
British Plastics Year Book, 569
Ceramic Fabrication Processes, edited by W. D. Kingery, 102
Changing Pattern of Distribution, The, by N. A. H. Stacey and A. Wilson, 39
Conformal Transformations in Electrical Engineering, by W. J. Gibbs, 278
Conquest of Time, The, by H. Horwood, 679
Crabtree Electrical Handbook, 644
Directory of Opportunities for Graduates, 226
Directory of Opportunities for Qualified Men, 68
Directory of Opportunities for School Leavers, 730
Electric Machinery, by Clifford C. Carr, 722
Electrical Maintenance and Repairs, by J. L. Watts, 102
Electrical Safety, by H. W. Swann, 1120
Electrical Trades Directory—Blue Book, 404
Electrical Year Book, 166
Electricity for the Grower, 1021
Electricity Supply Handbook, 643
Engineer Buyers' Guide, 315
5 Anni del Museo, 558
Foundations of Electrical Engineering—Vol. II, by H. Cotton and E. W. Golding, 922
Fourth National Symposium on Vacuum Technology Transactions, edited by W. G. Matheson, 58
Fuel Economy Review, 404
General Circuit Theory, by G. Newstead, 780
Heating and Ventilating Industry Year Book, 68
Interfirm Comparison for Management, by H. Ingham and L. Taylor Harrington, 148
Introduction to Electromagnetic Engineering, by R. F. Harrington, 558
Kempe's Engineer's Year Book for 1959, edited by C. E. Prockter, 278
Law and the Power Engineer, by Robert S. W. Pollard, 438
Lindsay's International Register of Wire, Rod and Strip, 119
Mathematics Applied to Electrical Engineering, by A. G. Warren, 438
Mechanical World Year Book, 166
Metal Industry Handbook and Directory, 685
Metal Rectifier Engineering, by E. A. Richards, 279
Modern Electronic Components, by G. W. A. Dummer, 1042
Multivibrator Circuits, by A. H. Bruinsma, 922
New Developments in Industrial Control, edited by M. D. Callender, 858
Noble Metal Thermocouples, by H. E. Bennett, 19
Patents for Engineers, by L. H. A. Carr and J. C. Wood, 1131
Performance and Design of Direct Current Machines, by Dr. A. E. Clayton, 942
Physics and Mathematics in Electrical Communication, by J. O. Perrine, 148
Practical Robot Circuits, by A. H. Bruinsma, 922
Principles of Electronics, by H. Buckingham and E. M. Price, 780
Principles of Noise, by J. J. Freeman, 58
Principles of Transistor Circuits, by S. W. Amos, 780
Radio Circuits, by W. E. Miller, 942
Radio Communication, by W. F. Lovering, 558
Railway Signalling Systems, by J. R. Day, and B. K. Cooper, 341
Railways into Roadways?—Are Railways Doomed?, 858
Refrigeration Simplified, by R. C. Scutt, 39
Sell's Building Trades List, 450
Solution of Problems in Electrical Technology, by H. Cotton and J. V. Parry, 58
Structure of Metals, The, 1042
Survey of Electric Power Equipment, 295
Tait's Electrical Directory of Australia and New Zealand, 610

New Books—*continued*

Technical Writer, The, by J. W. Godfrey and G. Parr, 1042
Telecommunication Principles, by R. N. Renton, 39
Theory and Design of Magnetic Amplifiers, The, by E. H. Frost-Smith, 722
Water Power Engineering, by Rolt Hammond, 341
Who's Who in Trade Agreements, 912
Wireless & Electrical Trader Year Book, 525

New Electrical Equipment—

Alarm, Dual temperature, 463
Ammeter, Welding, 320
Amplifier, Low frequency, 1023
Arc furnace electrodes, 563
Asbestos cloths, Aluminium faced, 920
Automatic voltage control unit, Precipitator, 1055
Automatic voltage regulator, 699
Battery chargers, 700
Bench light, 919
Blankets, Electric, 31, 1163
Blower, Centrifugal, 84
Box, Plateswitch mounting, 819
Brake motors, 792
Bushings, Interchangeable apparatus, 658
Cable drum stand, Hydraulic pay-out, 415
Cable glands, 564
Cable locator, 794
Cable tester, 657
Cable tracer, 819
Cable tray, 130
Cable trunking, 130
Capacitors: Fluorescent lighting, 31; Tubular, 819; P.t.f.e. dielectric, 919; High temperature, 919
Cathodic protection anodes, 235
Centrifugal blower, 84
Chain, Nylon, 564
Chokes, Silica-filled, 280
Circuit-breaker, Miniature, 920
Circulators, Immersion heater, 615
Clothes dryers, 319, 563, 792, 819, 918
Coffee percolator, 370
Coil winding machine, 657
Compression terminals, 319
Conductors, Transposed transformer, 699
Conduit, Rubber, 964
Connector blocks: Self-locking, 84; 3-way 60 A, 371
Connectors: Miniature, 564; Coaxial cable, 918
Contact lubricant, 792
Contactors: Emergency lighting, 318, 348; Mercury switch, 415; Heavy-duty, 879
Control equipment, Flameproof, 415
Control station, Insulated pendant, 745
Controllers, Cam-operated master, 1054
Convector heaters, 320
Conveyor oven, 30
Cooker control units, 31, 176
Cookers, 177, 361
Cooling radiators, 616
Counters: Photo-electric, 280; Magnetic, 280, 370; Electric, 371
Dehumidifier, Industrial, 1023
Detector, High-sensitivity, 370
Diagram plotter, Nyquist, 84
Dielectric heater, 85
Drill control unit, Flameproof, 563
Drill, Electric, 564
Drilling machine, Electronically controlled, 1163
Dry shavers, 415, 700, 1118
Dryers, Clothes, 563, 792, 819
Dryers, Spin, 319; Washing machines and, 85, 1119, 1164
Drying cabinet, 792, 819
Dust collector, 964
Earthing clamp, 793
Electrodes, Arc furnace, 563
Electrostatic generator, 658
Epoxide resin, 414
Fader, Twin-channel, 918
Fan heaters, 699
Fans: Centrifugal, 281; Corrosive gas, 920; Domestic type extractor, 1118
Fires, Electric, 280, 1119
Flameproof enclosures, 879
Flameproof equipment, 415, 563, 616, 879
Flash tester, 371
Floodlight, Sodium, 1023
Floor maintenance machine, 176
Fluid level controller, 414
Fluorescent lighting fittings, 84, 122, 176, 177, 235, 318, 794, 1164
Fly and moth killer, 319

New Electrical Equipment—*continued*

Food mixer, Built-in, 918
Furnaces: Batch, 699; Shaker hearth, 745
Glands, Cable, 564
Glow plugs, Diesel engine, 794
Grill, Infra-red, 699
Grinder, Surface, 463
Gyroscopes, Precision direction, 176
Hack-saw, Portable power, 745
Heaters: Dielectric, 85; Panel, 130; Convector, 320; Infra-red, 564, 657, 700, 918, 1163; Fan, 699; Induction, 1023
Humidity cabinet, Controlled, 615
Immersion heater circulators, 615
Indicator lamps, 31, 1163
Induction heating equipment, 1023
Infra-red grill, 699
Infra-red heaters, 564, 657, 700, 918, 1163
Insect killer, 319
Instruments, Multi-range, 176
Ironer, Rotary, 615
Joint boxes, Plastic, 657
Kettle, Fast boiling, 1054
Lamps: Indicator, 31, 1163; Projector, 965
Lampshade, Unbreakable, 918
Level controller, 414
Lifting magnets, 964, 1118
Lighting accessory, Plug-in, 84
Lighting fittings: Fluorescent, 84, 122, 176, 177, 235, 318, 794, 1164; Display, 130; Corrosive-resistant fluorescent, 176; Street lanterns, 235; Suspended ceiling, 371; Industrial movable arm, 414; Range of commercial and industrial, 561; School, 564; Shop window, 793; Industrial circular fluorescent and tungsten, 794; Bench, 919; Exterior, 1055; Wellglass, 1119; Fluorescent worklight, 1163
Limit switch, Plug-in, 1054
Line tapping equipment, 415
Low-voltage power unit, 563
Magnetic alloy, 371
Magnetic amplifiers, 414
Magnetic conveyor rolls, 370
Magnetic separator, 793
Magnets, Lifting, 964, 1118
Master controllers, Cam-operated, 1054
Metering panel, Flameproof, 616
Meters: Watthour, 415; Prepayment, 1054
Motor control gear: Remote control stations, 85; Automatic starters, 414, 879; Insulated pendant push-button unit, 745; Contactor-starters, 879
Motors: Totally enclosed, 280; Synchronous, 319; Torque, 657; Brake, 792; F.h.p., 1055
Mounting box, Plateswitch, 819
Multimeters, 176
Multiplier phototube, 84
Nickel plating plant, Small, 177
Nut, Potentiometer spindle, 84
Nut retaining rings, 793
Nylon chain, 564
Nylon cutter, 1023
Nyquist diagram plotter, 84
Oscilloscopes: Miniature, 414; Infinite persistence, 792
Ovens: Conveyor, 30; Medium capacity industrial, 318
Ozonators, 1119
Panel heaters, 130
Patchboard, 657
Pattresses, Socket-outlet, 794
Peak accelerometer, 880
Photo-electric counter, 280
Photomultiplier tubes, 563
Pipe manipulator, 319
Plating plant, Nickel, 177
Plug for diesel engines, 794
Plug, Heat regulating, 700
Polarising supply unit, 919
Potential indicator, 414
Potentiometer spindle nut, 84
Potentiometers: Electronic, 31; Hollow spindle, 964
Power point, Portable, 700
Power unit, Low-voltage, 563
Precipitator voltage control, Automatic, 1055
Prepayment meter, Florin, 1054
Process control equipment, Industrial, 793
Process timer, 319
Push-button unit, Insulated pendant, 745
Pyrometer, Radiation, 30
Radiation pyrometer, 30
Radiators, Cooling, 616
Recorders: Electronic strip-chart, 371; Miniature, 964; High-speed potentiometric, 1119

New Electrical Equipment—*continued*

Reflectors: Plug-in unit for, 84; Shop window, 793
Refrigerators, Domestic, 131, 167, 280, 318, 414
Relay test set, 371
Relays: Polarised, 30; Comb, 30; Precision, 85; Miniature sealed, 280; Encapsulated mercury, 280; Motor protection, 370; Interlocking, 463; Plug-in, 657; Withdrawable, 879; Coaxial, 879; Monitoring, 1164
Remote control stations, 85, 745
Remote level controller, 658
Resistors, Wire-wound, 819
Retaining rings, Nut, 793
Rotary ironer, 615
Rubber conduit, 964
Seconds timer, 918
Sequence controller, 235
Shavers, Dry, 415, 700, 1118
Shock measurement equipment, 880
Shop window reflector, 793
Smoke alarm equipment, 235
Socket outlet pattresses, 794
Soldering iron, 176
Soldering machine, 616
Spin dryers, 319; Washing machines and, 85, 1119, 1164
Spur connector, Fused, 130
Staff location system, 415
Street lanterns, Vertical fluorescent, 235
Stroboscope, High powered, 792
Surface grinder, 463
Suspended ceiling fitting, 371
Switches: Miniature, 177; Sparkless, 370; Multi-circuit a.c., 615; Rotary stud, 918; Plug-in limit, 1054; Illuminated press, 1118
Switch-socket outlets, 30, 880
Tape recorder, 615
Telephone, Automatic, 1055
Temperature alarm, Dual, 463
Terminal blocks: Self-locking, 84; Spring-loaded, 130
Terminals, Compression, 319
Test sets: Relay, 371; Transistor, 563, 1055; Cable insulation, 657
Thermistors, 414
Thermocouples, Mineral insulated, 965
Thermostats: Heating-system, 370; Reverse action, 919
Time delay unit, 819
Timers: Multi-circuit, 235; Process, 319; Electronic, 415; Seconds, 918
Torque motors, 657
Transformer conductors, Transposed, 699
Transformers: Small l.v., 30; Flameproof lighting, 616
Transistor test sets, 563, 1055
Trunking, Power and communication circuit, 130
Tug, Electrical, 415
Turbine condenser protection, 176
Vacuum cleaners: Domestic, 280; Industrial, 1164
Valve voltmeter, 918
Valves, Microwave, 793
Voltage control, Automatic precipitator, 1055
Voltage regulators, 318, 699, 879
Voltmeters: Digital, 463, 1118; Valve, 918
Washing machines and spin dryers, Combined, 85, 1119, 1164
Water boilers, Bulk, 1118
Watthour meter, 415
Welding equipment: Pipe manipulator, 319; Ammeter, 320; Butt, 463; Mobile, 699; Arc, 699, 880; Stud —— power unit, 745; Spot, 919
Wiring system, Portable, 879
Worklight, Adjustable fluorescent, 1163
X-ray unit, Industrial, 131
Zener voltage regulators, 879

New Year Honours List, 48, 65
New Zealand: Cook Strait scheme review, 29; Waikato hydro-electric project, 82; Cable for, 222; Geothermal power for paper mill, 271; Lamp manufacture in, 404; Lord Citrine's visit to, 454; Wairakei geothermal power project, 566; Aluminium factory project, 728; Power position improvement in, 756; Bowthorpe subsidiary in, 871; Transformers for, 913; Impregnated pressure cable installation, 1145; Motor control equipment for, 1145
Newcastle railway signalling installation, 730
Newman Spinney underground gasification tests: End of, 250, 972; Description of, 987

N. Georgios, Switchboards for, 18
Niagara floodlighting installation, Film on, 183
Nickel alloys: Booklet on, 488; Exhibition, 869, 955
Nickel Bulletin, 526
Nickel position, World, 1001
Nigeria: Crushing plant for, 315; News from, 455; Hydro-electric project, 566, 950; Sales of electricity, 566; New companies in, 955; Electrical imports, 1101
Nitrogen factory, Motors for a, 1021
North America, Selling electric fires in, 267
North Eastern Electricity Board: Tariff changes, 128, 454; All-electric house costs, 271; Payment of bills by instalments suggestion, 795; Objection to estate supply terms, 864
North Eastern Trading Estates, Activities of, 19
North of Scotland Hydro-Electric Board: Strathfarrar-Kilmorack scheme, 29, 529, 701, 821; 1958 generation figures, 232; Shin scheme power stations operating, 270; Annual report, 432; Loch Awe scheme, 472, 656, 958; Glen Cova supply inaugurated, 565; Rural electrification progress, 656; Contracts placed, 701, 821; Loch Glashan project, 701; Capital expenditure, 720; All-Electric Housing Exhibition, 730; Orrin dam project, 746; Conon Valley schemes, 746
North Western Electricity Board: Allowances on old cookers, 172; Tariff changes, 528; Penrith-Alston line approved, 529; Domestic appliance sales, 821; Twenty millionth saving stamp sold, 950
Northern Ireland: Belfast housing policy, 528; Nuclear power station project, 566; Electricity Board's borrowing powers, 864; Fish-stunning equipment used in, 1053
Northfleet power station, Plant for, 270
Norvick, Vera, Memorial Fund, 346
Norway: Telecommunication equipment for, 164; Radar equipment for, 283; Eurovision link, 360
Nuclear electricity experiment, 719
Nuclear energy industrial prospects, European conference on, 731
Nuclear engineering company, New, 267
Nuclear Equipment, Formation of, 1059
Nuclear fission, by R. F. Jackson, 23
Nuclear fuel production: Springfields factory for, 233; —— by private firms, 821
Nuclear Installations (Licensing and Insurance) Bill, 347, 865
Nuclear marine propulsion, 538, 826, 886, 899, 1043
Nuclear metals, Booklet on, 644
Nuclear power: Euratom agreement, 226, 290, 312; —— in Canada, 330; Exports, 623, 656; Exhibition, 821; G.E.C.-M.A.N. agreement, 1001, 1056; Reappraisal of, 1142
Nuclear power plant auxiliaries, by W. Johnson, 49
Nuclear power stations: Chapelcross, 66, 424, 454, 843, 845–850; Electrical installation at Calder Hall, by N. J. Mackay and E. Hardwick, 170; Berkeley, 201, 311, 1058, 1145; Bradwell, 201, 613; Hinkley Point, 201, 454, 1104, 1162; Hunterston, 201, 430, 526, 568; Japanese project, 307, 397, 424, 455, 612, 641, 666, 684, 715; British Guiana project, 325, 484; British programme, 347; South Coast sites investigations, 369, 776; Postponement of Argentine plans, 369; Mineworkers call for postponement of, 397; Welsh sites investigations, 413, 565; Sizewell site, 454; German project, 455, 472; Siting of, 483; Lloyd's inspection and site services at, 557; Ulster project, 566; Brazilian projects, 566; Oldbury-on-Severn site, 614; Broadsheet on markets for, 647; Swedish projects, 649; Australian interest in, 685; Erection costs, 756; Proposed Sussex site, 776; French, 865; Plant for Italian, 1056; Progress on the first, by F. H. S. Brown and J. Henderson, 1034, 1086; Trawsfynydd, 1148
Nuclear powered merchant ship, World's first, 1043
Nuclear reactor auxiliaries, by B. H. Stonehouse, 253
Nuclear reactors: Australian, 173; New research —— for Windscale, 303; Japanese project, 307; Danish, 346; Winfrith Heatl. project, 353, 361, 642; Sub-critical laboratory, 405; —— for ships, 538, 826, 886, 899, 1028, 1043; Irish decision on, 566; Anglo-American companies' agreement, 1059; Canadian experiment, 1061
Nuclear research: C.E.G.B. —— centre project, 484; Industrial television for, 790; —— at Aldermaston, 1126
Nylon setting plant, Infra-red, 68

OAKY River (N.S.W.) hydro-electric scheme, 83

Obituary—
Adams, G. A., 683
Andrews, W. H. J., 217
Angwin, Sir Stanley, 771, 824, 953
Ashton, F., 154
Atkinson, C. H., 154
Bamford, A. S., 910
Bastie, P. H., 824
Bennett, G., 910
Blandford, A. R., 727
Bloomfield, T. G., 868
Boutle, H. S., 727
Brazel, Lt.-Col. C. H., 824
Brook, J., 396
Brook, K., 1000
Browett, Sir Leonard, 910
Burbidge, A. J., 727
Burns, M., 346
Busemann, Dr. F., 868
Butler, H. S., 953
Chalmers, J. A., 771
Cox, E. F., 396
Crowther, J., 909
Dalton, Sir John, 952, 1000
Darbyshire, Dr. J. A., 307
Denton, H., 1109
Eckersley, Dr. T. L., 345
Emanueli, L., 345
Fraser, Col. H. G., 346
Gillam, W. T., 1000
Greenwood, J. R., 592
Hargreaves, F. G., 910
Harpur, R. C., 396
Hopkirk, K. R., 824
Howitt, H., 727
Krzhizhanovsky, G. M., 727
Larke, Sir William, 868
Levett, L. E., 868
Lynden, R. C., 1000
McFarlane, W., 553
MacGregor-Morris, Prof. J. T., 592
Mair, J., 868
Mallinson, A. B., 771
Mavor, J. B., 260
Millar, Sir Jackson, 15
Millatt, H. W., 109
Milne, Sir William R., 683
Moxham, R., 64
Myers, C. T., 824
Newton, J., 771
Oakes, Sir Cecil, 154
Orchard, S. G., 64
Oswald, H., 108, 217
Parton, E. R., 771
Pattenden, R., 868
Payn, H., 824
Pearcy, W. F., 488
Phillips, S. R., 553
Picken, W. J., 436
Ramsay, J., 953
Richardson, Sir Owen, 346
Robertson, W. R., 396
Robinson, I. V., 824
Robson, O. L., 868
Sayers, Mrs. H. M., 910
Shannon, J., 109
Shepherd, Sir Walker, 436
Singer, Mrs. W., 15
Smith, H. H., 640
Smith, J. F., 683
Stott, J. N., 15
Sulzer, Dr. H., 64, 109
Taylor, E., 727
Thorn, G. W., 553
Tonkinson, W., 260
Turpie, W. L., 15
Twinberrow, J. O., 909
Ward, Sir Ashley S., 683
Wasden, B., 910
Webber, H., 553
Wells, S. J. C., 1151
White, C. L. B., 683
Wilkins, H. F., 396
Yorke, J. P., 1000

Oil consumption in 1958..956
Oil tanker, Generating plant for new, 316
Operational efficiency of power stations, Improving, 885
Organisation for European Economic Co-operation: Publications, 166, 295; Report on electricity supply in Europe, 688; Report on industrial design in the United States, 744
Orrin dam project, 746
Oscilloscope, Angle measuring, by K. Rigby, 296
"Outer Seven" trade talks, 1058
Overhead lines, *see* Transmission lines
Overseas electrical trade, 26, 227, 392, 597, 814, 1017
Owen Falls power station, Minister's visit to, 864
Oystermouth and Mumbles railway, Proposed closing of, 301, 321

PANELEC (G.B.): Integration with parent company, 525
Paper capacitors, Reliability of, by J. P. Pitts, 481
Paper industry, Electric drives in the, by P. D. House, 562
Parliament, Industry and, by A. M. F. Palmer, 261, 439, 593, 817, 1009
Parliamentary report, 226, 321, 347, 397, 462, 489, 567, 614, 656, 723, 776, 821, 865, 910, 958, 1147
Parsons, C. A., & Co.: American turbo-alternator contract, 485, 489, 1050
Peace River hydro-electric project, 567, 795
Pedestrian crossings, Floodlit, 790
Pension scheme, Manufacturers', 182
pH measurement and control, Industrial, by R. S. Evans, 1114
Philco-Thorn Electrical agreement, 266
Physical Society Exhibition, 139; Survey of, by P. L. Degen, 159
Pipe bending manual, 730
Plant and machinery rating, Committee's report on, 265
Plasma arc torch, 684
Plastics Exhibition, International, 554, 1092, 1125, 1135
Plastics factory, New, 119
Plastics for insulation, 425
Plastics industry, Electronics in the, by P. E. Merry, 693
Plastics Institute revised regulations, 953
Plessey Co.: German subsidiary, 870; Licensing agreement, 955; Canadian contract, 956
Pneumatics and Hydraulics Exhibition, 790
Poland: Trade negotiations with, 21; Tinning plant for, 1102
Port of London Authority, Cranes for, 68
Portugal: Lisbon Trade Fair, 347, 526, 687; A challenge to British exporters, 943; Seixal power station contract, 1144
Post-graduate research, 472
Post Office: Radio transmitters for, 405; 1959–60 programme, 608
Power station auxiliary supplies, by D. A. Dewison, 808
Power station coal handling, by A. Szold, 95
Power station design, Economics of, by J. T. Moore, 589
Power station efficiencies: Improving, 885; 1958 figures, 907
Power station extensions, 347
Power station, Mobile, 1096
Power station plant, Towards higher efficiency in, 379
Power station sites: Bradwell, 201, 613; Berkeley, 201, 311, 1058; Hinkley Point, 201, 454, 1104, 1162; Hunterston, 201, 430, 526, 568; Northfleet, 270; Richborough, 347; South coast nuclear —— investigations, 369, 776; Welsh —— investigations, 413, 565; Sizewell, 454; Ulster, 566; Oldbury-on-Severn, 614; East Midlands, 614; Sussex, 776; Drakelow "C," 820; Slurry burning, 910; Cape Town, 1012
Power stations (*see also* Nuclear power stations): Hong Kong, 16, 82; Blyth "A," 28, 381; Kincardine, 28, 614, 648, 887; Underground hydro-electric, by B. K. R. Prasad, 77; Bersimis II, 119; High Marnham, 119, 781, 1102; 1958 coal consumption of, 128; Salisbury (Rhodesia), 169; Use of coal in, 226; Loch Shin scheme, 270; Skelton Grange, 270; Coal-oil conversions postponed, 489; River Clady (Eire), 614; Closure of Folkestone, 648; Experimental remotely

controlled, 795; Drakelow "C," 820; —— and agriculture, 821; Boots' Beeston, 861; Bankside "A," 864; Chilean projects, 865; Owen Falls, 864; Improving operational efficiency, 885; 1958 efficiency figures, 907; Closure of Woking, 937; Liquid fuel firing of, 941; Thorpe Marsh, 957; Blyth "B," 957; Schedule of British, 989; Manama "B," 1095; Clarence Dock, 1104; Bow, 1143
Powers-Samas-Hollerith merger, 268
Preformed Line Products (Great Britain), Andover factory of, 308
Pressed Steel Co., New factory for, 526
Prices: —— and competition, 289; B.O.T. figures of —— and sales, 788
Printed circuits: Exhibition, 729; High current, 789
"Priority No. 1," by A. N. Irens, 1036, 1087
Pumped storage schemes, Scottish, 472, 656
Purchase tax, 244, 462, 656, 865, 928, 950

"QUAINTWAYS" restaurant kitchen installation, 409
"Quick Freeze" exhibition, 120

RADAR: Training installation, 166; Liverpool Port installation, 266; Equipment for Norway, 283; Jordanian contract, 535; Demonstration of marine, 610; N.A.T.O. early warning chain, 1103
Radiation Group, New headquarters for, 642
Radiation monitoring service, 642
Radiation shielding, 570
Radio: Acoustic design of studios, by C. L. S. Gilford, 25; V.h.f. equipment for Australian Army, 164; High power transmitters for G.P.O., 405; Equipment for Maldive Islands, 610; Valve agreements ended, 641
Radio and Electronic Components Exhibition, 624, 689–692
Radio Exhibitions, Formation of, 404
Radio Industry Council reconstituted, 314, 404
Radio officers' training college, 121
Radiography, Cobalt, 686
Radiological protection, 776
Railway bridge floodlighting, 955
Railway electrification: Locomotives for British, 20, 206, 250, 924; Progress of British, 206; Electrical testing laboratory, 74; Kent lines, 129, 206, 701, 1126, 1149; Scottish, 321; Film on, 358; Problems of, by R. E. Sadler, 478; Crewe-Manchester line cable contract, 684; Colchester-Clacton line opened, 723, 757; Traction voltages, 756; High voltage indicator for, 920; Southern Region electric locomotives, 924; French, 924; West German, 924; Supervisory control equipment for, 1103
Railway industry, Electronics in the, by B. K. Cooper, 335
Railways: Remote control on, 7; Locomotives for modernisation scheme, 20, 206, 250, 406, 452, 462, 525, 789, 805, 924, 954, 1145; Voltage control of battery signalling, 24; Research laboratory, 74; Shenfield train indicators, 120; Proposed Victoria tube line, 301, 321, 462, 614, 1147; Oystermouth and Mumbles, 301, 321; Report on Underground train fire, 313, 334; Equipment for Underground lines, 359; Argentine, 360; New Notting Hill Gate station opened, 434; Derby works reorganisation, 451; Bank Station "Travolator," 612; Buenos Aires underground project, 621; Improved Underground station lighting, 701; Locomotives for South Africa, 728; Newcastle signalling installation, 730; Peak Class diesel-electric locomotives, 805; Festiniog, 807; Modernisation scheme for Underground, 818; Train telephone installations, 826; Crewe floodlighting installation, 962; Temple Mills marshalling yard, 1117
Ramp heating installation, 643
Rand Easter Show, 260
Rates: Electricity and, 462; Power station, 599
Rating, Committee's report on plant and machinery, 265
Raytheon-Ferranti agreement, 221
Recorder for telephone messages, 164
Recruitment of professional electrical engineers, by K. L. Stretch, 1093
Rectifiers: Silicon, 380, 569; Manufacture of germanium, 445; Contact, 647
Refrigeration association, European, 268
Refrigerators: New domestic, 167; Exhibitions, 314, 827; Hire-purchase terms, 565; Revised British Standards, 818; Survey of domestic, 832; Electric ——, by D. C. Billing, 929
Remote control of distribution networks, by L. J. Day, 140, 141

Reports and Dividends—
Aberdare Cables Africa, 88
Aberdare Holdings, 574, 875
Ada (Halifax), 467, 1113
Aerialite, 875
Aiton & Co., 180
Allen, Edgar, & Co., 180
Allen, W. H., Sons & Co., 88, 1154
Allen West & Co., 1112
Anglo-Portuguese Telephone Co., 875, 1068
Arcolectric (Holdings), 238
Associated Electrical Industries, 42, 134, 238, 532, 660, 774, 1005
Automatic Telephone & Electric Co., 917, 967
Avo, 660
Babcock & Wilcox, 830, 916
Bagdad Light & Power Co., 575
Bakelite, 575, 874
Bird, Sydney S., & Sons, 660
Birmingham Sound Reproducers, 916
Blaw Knox, 750, 1005
Bowthorpe Holdings, 968
British Aluminium Co., 42, 88, 134, 239, 418, 750, 874
British Engine Boiler & Electrical Insurance Co., 775
British Insulated Callender's Cables, 134, 239, 374, 750, 1111
British Oxygen Co., 418
British Relay Wireless & Television, 180, 374
British Thermostat Co., 968
British Vacuum Cleaner & Engineering Co., 284, 466
Brook Motors, 238, 917
Bruce Peebles & Co., 328, 574
Bulgin, A. F., & Co., 660
Bullers, 1005
Bulpitt (Swan Brand), 661, 968
Burco Dean, 88, 968
Bylock Electric, 467, 660
Cable & Wireless (Holding), 328, 831
Cables Investment Trust, 180
Calcutta Electric Supply Corporation, 180
Camp Bird, 704
Canning, W., & Co., 775
Chloride Electrical Storage Co., 775, 1154
Clarke, Chapman & Co., 418, 660
Clarke, T., & Co., 874, 1004
Clifford, Charles, 661
Cohen, George, 600 Group, 418
Cole, E. K., 533
Contactor Switchgear, 831
Cossor, A. C., 775
Courtney, Pope (Electrical), 619
Crabtree Electrical Industries, 328
Crompton Parkinson, 1069
Desoutter Brothers (Holdings), 532, 661
Direct SpanishTelegraph Co., 418
Dorman, W. H., & Co., 284
Dowty Group, 374
Ebonite Container Co., 42
Edwards High Vacuum, 775
Electric & Musical Industries, 574
Electrical Apparatus Co., 750
Electrical Components (Holdings), 328
Elliott-Automation, 661, 830, 1112
Enfield Cables, 775, 967
Enfield Rolling Mills, 619, 775, 874
Engineering & Lighting Equipment Co., 968
English Electric Co., 42, 180, 284, 374, 618
English Electric Group, 374, 466
Ericsson Telephones, 574, 704
E.V. Industrials, 180
Eveready South Africa, 875
Ever Ready Co. (Great Britain), 968, 1154
Ever Ready (Ireland), 1069
Ever Ready Trust Co., 831
Falk, Stadelmann & Co., 418, 467
Fenner, J. H., & Co. (Holdings), 42
Ferranti, 1154
Franco Signs, 574
General Cable Manufacturing Co., 42, 284
General Electric Co., 238
Globe Telegraph & Trust, 180
Greenwood & Batley, 134
Hackbridge Holdings, 42
Haden, G. N., & Sons, 968
Hall, J. & E., 532, 1067
Harland Engineering Co., 775, 1068
Head Wrightson & Co., 180

Reports and Dividends—*continued*
Heatrae, 1069
Hilger & Watts, 284, 704
Holophane, 968
Hoover, 467, 532, 704
Hopkinsons, 776, 1068
Howden, James, & Co., 619
Hunt, A. H. (Capacitors), 619, 704
International Combustion Africa, 418
International Combustion (Holdings), 374, 466
Johnson & Phillips, 1069, 1112
Johnson, Richard, & Nephew, 1005
Kango Electric Hammers, 775
Lancashire Dynamo Holdings, 775, 1004
Laurence, Scott & Electromotors, 830, 1067
Lightfoot Refrigeration, 1005, 1112
Lindley Thompson Transformer & Service Co., 180, 466
Lister, R. A., & Co., 238
London Electric Wire Co. & Smiths, 42, 134, 284, 775
Lucas, Joseph (Industries), 750
Marco Refrigerators, 134, 238
Marconi International Marine Communication Co., 619
Marconi's Wireless Telegraph Co., 618
Marryat & Scott, 374
Mather & Platt, 418, 704
Matthew Hall & Co., 1005
Mavor & Coulson, 775, 968
Metal Industries, 374, 418, 660
Midland Electric Manufacturing Co., 466, 574
Morgan Crucible Co., 88
Morphy-Richards, 467, 532, 750
Murphy Radio, 750
National Electric Construction Co., 831
Newman Industries, 830
Nigerian Electricity Supply Corporation, 661
Nuclear Investment Co., 374
N.V. Philips Gloeilampenfabrieken, 619
Parkinson & Cowan, 750
Parmiter, Hope & Sugden, 467
Parsons, C. A., & Co., 775, 874
Peerless & Ericsson, 42
Perak River Hydro-Electric Power Co., 750
Philips Electrical, 661
Philips Gloeilampenfabrieken, 619
Pifco Holdings, 750
Pirelli-General Cable Works, 532
Plessey Co., 88, 830, 1068
Power Securities Corporation, 917, 1004
Pullin, R. B., & Co., 239, 830
Pulsometer Engineering Co., 830, 967
Radiation, 831, 1068
Radio & Television Trust, 284, 374
Radio Rentals, 134, 328, 532, 875
Rediffusion, 418
Relay Exchanges, 466, 660, 704
Reliance-Clifton Cables & Industrial Products, 1112
Reyrolle, A., & Co., 750, 830
Rheostatic Co., 775
Richardsons, Westgarth & Co., 1005
Sanders, Wm., & Co. (Wednesbury), 831
Sangamo Weston, 660
Scholes, George H., & Co., 776
Scott, James, & Co. (Electrical Engineers), 180
Scottish Cables, 1111
Senior Economisers, 750, 1112
Simms Motor & Electronics Corporation, 750
Simon-Carves, 532, 830, 1067
Smith, S., & Sons (England), 968
Spencer Wire Co., 831
Sterling Cable Co., 418
Stone, J. & F., Lighting & Radio, 750
Stothert & Pitt, 575
Strand Electric Holdings, 750
Sturtevant Engineering Co., 750, 916
Sun Electrical Co., 88
Superheater Co., 704, 1068
Switchgear & Cowans, 619
Taylor, Tunnicliff (Electrical Industries), 467, 574, 1005
Taylor, Woodrow, 916
Telegraph Condenser Co., 532, 750
Telegraph Construction & Maintenance Co., 134, 374
Telephone & General Trust, 660
Telephone Manufacturing Co., 1068
Telephone Rentals, 917
Thermotank, 1067
Thompson, John, 1005
Thornycroft, John I., & Co., 968
Truvox, 619
Tube Investments, 875
Turner & Newall, 1069

Reports and Dividends—*continued*
Ultra Electric, 533
Ultra Electric (Holdings), 180
Universal Asbestos Manufacturing Co., 532
Vent-Axia, 1068
Veritys, 88, 180, 375, 532, 619, 704
Vickers, 916
Walsall Conduits, 1154
Ward, Thos. W., 575
Watford Electric & Manufacturing Co., 661
Weir, G. & J., Holdings, 704, 967
Westinghouse Brake & Signal Co., 180, 238
Wolf Electric Tools, 660, 917
Worthington-Simpson, 830
Yarrow & Co., 42

Research: Post-graduate, 472; Industrial use of, 1028
Resin plant, New, 1019
Resinoid & Mica Products, New factory of, 119
Resistance materials, Booklet on, 790
Resonators, klystrons and wave tubes, Papers on, 410
Restaurant kitchen installation, 409
Restrictive labour practices, Report on, 346
Restrictive practices and the public interest, 766
Restrictive Practices Court, 289, 766
Restrictive Trade Practices Act, 580
Restrictive Trading Agreements, Registrar of: Summary of work of, 109, 164
Revo Electric Co., Switchfuse manufacture at works of, 411
Rhodesia and Nyasaland: Salisbury No. 3 power station opened, 169; Electricity charges, 173; Kariba hydro-electric scheme, 314, 358, 452, 865; Norton substation, 648; Southern Rhodesia Electricity Supply Commission's annual report, 698; Traction motors, 790
Richborough power station project, 347
Ring main concept, by W. Casson, 542
Ripaults, Lighting installation at works of, 451
River Forth pollution inquiry, 454
Road heating installations, Electric, 262, 369, 701
Rocket research, Cables for, 1100
Rolling mill, Mobile demonstration of automatic, 316, 869
Royal Botanic Garden, Edinburgh, Cable for, 569
Royal Society conversazione, 948
Royal Society of Arts: Industrial art bursaries competition, 541, 870
Rubber supply, World, 1056
Rudder, Pleuger "Aktiv," 20
Rural electrification plans, 232
Russia: Seven-year plan, 271; Tyre factory project, 404, 643, 869; British trade delegation's visit to, 567; British trade mission to, 825, 869; Refrigerating plant for, 912, 955; Automatic control team's visit to, 957; British trade agreement, 1019; Landing systems contract, 1019; Mobile power station for, 1096
Rustyfa tyre factory consortium, 404, 643, 869

SAFETY in the home, Booklet on, 359
St. Clement Danes' church, Bell ringing mechanism at, 357
St. Lawrence power project, 1104
Salaries, Power engineers', 165
Sales of durable goods, B.O.T. figures of, 788
Salisbury (Rhodesia) No. 3 power station opened, 169
Sarawak, Electricity supply in, 907
Saro-Nuclear Enterprises, Formation of, 267
Savannah, n.s., 1043
Scholarships, English Electric, 450
School, Scottish all-electric, 640
Schoolboys' Own Exhibition, 69
Scientific Instrument Manufacturers' Association: Annual luncheon, 948
Scientific instruments, Survey of Physical Society exhibition of, by P. L. Degen, 159
Scientific library project, 74
Scientists, Shortage of trained, 423
Scottish Dairy Show, 452
Scottish electrical firms, Merger of, 913
Scottish Electrical Training Scheme, 538
Scottish Industries Exhibition, 450
Seal of approval, British Safety Council's, 549, 592
Sealing compounds, Pamphlet on, 166
Selsyns, Booklet on, 790
Semiconductors: Mullard factory expansion, 855; Development of, 928; Transistors and, by I. G. Cressell, 1045; Booklet on, 1145
Service Centres: Newport, 19; Stevenage, 128; Display competition, 826, 955
Service connections, by E. H. Jesty, 322
Servicing manuals, Inadequate, 799
Severn Tunnel pumping plant contract, 526
Shark barriers, Electric, 105, 449
Sheet, strip and wire sizes, B.S.I. committee's decisions on, 162
Ship, Nuclear powered merchant, 1043
Ships: Electrical steering equipment, 20; Synthetic rubber insulated wiring installation, 451; Nuclear propulsion of, 538, 826, 886, 899, 1028, 1043
Shorter working week, Engineering unions' claim for, 380, 403
Showrooms: Electricity Boards', 19; Falks' Johannesburg, 121; Instrument, 166; Mobile, 526, 569
Siemens Edison Swan (Canada), Office extensions for, 70
Sign design competition, 359, 452
Signalling apparatus, Voltage control of battery operated railway, 24
Silicon manufacture, Plant for, 366
Silicon rectifiers, 380
Silicone insulation, by J. H. Davis, 123
Silicone laminates, Booklet on, 789
Simmonds Aerocessories: New Australian factory, 1020
Simon-Carves-Bruce Peebles agreement, 825
Simplex Electric Co.: Sales conference, 360
Singapore: City electrical engineer's annual report, 172; Cable laying in, 271; Electrical imports of, 575; Transformers for, 729
Sizewell nuclear power station site, 454
Skelton Grange power station, Steam drum for, 270
Slewing hooks, Motorised, 1144
Sloan Electrical Co., New Bristol branch of, 641; Diamond jubilee exhibition, 727
Smith, Frederick, & Co., Centenary of, 1056
Smith, S., & Sons (England): Co-ordination scheme, 222
Smithfield House cold storage plant, 1015
Smoke control leaflet, 454
Snake River hydro-electric project, British tender for turbines for, 244
Snowy Mountains hydro-electric scheme: Upper Tumut switching station, 455; 330 kV oil-filled cable installation, 688; First power from, 907
Society of Instrument Technology, Annual general meeting of, 980
Socket-outlets, Hazards to children from, 59
South Africa: Electric shark barriers, 105; Falks Electrical new showroom, 121; Rand Easter Show, 260; Plant for, 271, 317, 450, 611; Electric locomotives for, 728, 1020; Presentation to Witwatersrand University, 956; News from, 1012; Cape Town power station progress, 1012; Large electric furnace, 1012; Cape Town boiler plant tenders, 1100
South Eastern Electricity Board: Catering equipment exhibition, 789
South of Scotland Electricity Board: Kincardine power station set commissioned, 28; Reducing meter reading costs, 172; New hire-purchase terms, 232; 1958 generation figures, 232; Glasgow switching station project, 369; Scottish Dairy Show exhibit, 452; River Forth pollution Order inquiry, 454; Annual report, 528, 538, 559; British Oxygen Co. v., 529, 787; "Try it Yourself" exhibition, 609; Kincardine contracts, 614, 648; Capital expenditure, 720; Connection charges request, 746; Accounts complaint, 903; Buried type distribution transformers for, 911; Change of address, 913; Edinburgh Ideal Home Exhibition stand, 1103
South Wales docks modernisation schemes, 611
South Wales Electricity Board: Newport showrooms, 19; Tariff changes, 528, 648; Pembrokeshire reinforcement, 648
South Wales Switchgear: Apprentices booklet, 527
South Western Electricity Board: Prizes for students, 67; Hartland Point lighthouse mains supply, 172; Rural electrification programme, 232; First aid and safety trophies awards, 686; Taunton District reorganisation, 747; Experimental remotely controlled power stations, 795; Service Centre competitions, 826, 955; Catering equipment exhibition, 912
Southern Areas Electric Corporation: Merger of subsidiaries, 526
Southern Electricity Board: Complaints procedure, 613
Southern Outfall Works, Pumps for, 610
Southern Rhodesia Electricity Supply Commission's annual report, 698
Space research, British plans for, 958
Spartan Steel & Alloys, Works extension of, 67
Speed control of lifts, Electronic system of, by D. M. C. Dick and D. Embrey, 244, 245
Spin and tumbler dryers, Survey of, 650
Sports grounds, Machine for laying heating cables in, 1057
Springfields uranium processing factory, 233
Standard Telephones & Cables, 75th anniversary brochure, 870
Static power invertor, 643
Static regulation and excitation, New alternator employing, 229
Statistics, Electrical manufacturing, 886, 921
Steam condensers, Heat transfer in, 75
Steam drum, Unusual, 270
Steam, Properties of superheated, by Prof. J. H. Horlock, 634
Steel foundry service, 826
Steel plant modernisation, 419
Steel, Plastic coated, 164
Steelworks: Mill motor drive contract, 21; Extension, 67; Finance for new mills, 140; Batteries for Indian, 314
Store, Electrical installation at large department, 473
Strathfarrar-Kilmorack hydro-electric scheme, 29, 529, 701
Street lighting: Ministry of Transport national survey of, 321; Acton modernisation scheme, 329; Great West Road installation, 329; Conference, 453; Column design competition, 570; Need for uniformity, 656; Hendon installation, 751; Main traffic roads experimental installation, 864
Students, Grants to, 844
Studios, Acoustic design of, by C. L. S. Gilford, 25
Submarine, Nuclear powered, 321, 567
Substations: Hornchurch, 325; Rhodesian, 648; Mobile mining, 853; Willenhall extension, 1058
Sudan: Sennar Dam hydro-electric project, 165, 359, 643; Electric locomotives for, 316
Supergrid: Northfleet-Canterbury line, 413; West Thurrock Thames crossing, 528; Elstree-Finchley project, 820; Kent lines, 910
Superheated steam, Properties of, by Prof. J. H. Horlock, 634
Surface Coating Resin Index, 789
Swan, Sir Joseph, and the development of the electric lamp, by Dr. J. N. Aldington, 444
Sweden: Microwave telecommunications equipment for, 568; Power Board's jubilee, 649; Atomic power projects, 649; Stockholm district heating scheme, 746; Television equipment for, 1021
Switchboards for oil tanker, 18
Switchfuse manufacture and testing, 411
Switchgear, Standardisation and simplification of, by M. J. L. Willison, 562
Switzerland: Import Exhibition, 451

TANKER, Plant for Australian, 1144
Tariffs, Electricity: East Midlands Board, 82; North Eastern Board, 128, 454; Southern Rhodesia, 173; Floor warming, 270; Eastern Board, 413, 454, 565, 907; Off-peak, 489, 648; North Western Board, 528; South Wales Board, 528; Yorkshire Board, 565; Midlands Board, 613; London Board, 648, 1024; Sydney (N.S.W.), 649, 1104; Uganda Board, 746; Boarding house, 907
Teaching of electrical engineering, by A. T. Craven, 672
Technical Education, 269
Technical information service, Welsh, 789
Technical training in America, by K. R. Sturley, 717
Technical writing, Premiums for, 526
Telecommunication measuring equipment exhibition, 239
Telecommunications, The conceivable future of, by Prof. E. C. Cherry, 985
Telephone exchange automatic standby plant, 934
Telephone message recorder, 164
Telephones: Bristol subscriber trunk dialling installation, 20; New G.P.O. instrument, 21; Equipment for Norway, 164; Transatlantic cable fault, 397, 438; Transatlantic cable developments, 438, 489; Carrier system equipment, 548; Second

transatlantic cable project, 553; Equipment for Jordan, 568; Trunk dialling exchange contract, 570; Commonwealth —— cable project, 614, 980; British progress, 624; Bahamas radio —— contract, 643; Scotland-Faroes-Iceland cable project, 685; Iranian radio —— contract, 730; Self-supporting cable, 826; Train installations, 826; Radio —— equipment for Canada, 956; Imperial College exchange, 957; Automatic trunk switchboard, 1076; Hong Kong submarine cable, 1101; Multi-channel link for Finland, 1103
Television: Tyne Tees station, 164; B.B.C. booklet on, 164; Tube repair service, 358; Norway to join Eurovision, 360; Prospects of line definition change, 462; Convention, 527; Birmingham-Norwich link, 731; Industrial —— for nuclear research, 790; Equipment for Brazil, 954; Tube guarantee, 957; Wide-angle tube production, 965; Demonstration of industrial, 1020; Equipment for Sweden, 1021
Temperature measurements, Pamphlets on, 68
Temple Mills railway marshalling yard, 1117
Tennessee Valley Authority, British turbo-alternator for, 485, 489, 614, 1050
Terms and conditions of employment, Enforcement of, 800
Testing plant in service, 755
Textile industries, Electronics in the, by W. E. Swale, 625
Thermionic emitters, Survey of high-current-density, by A. H. W. Beck, 158
Thermoelectric generator, 1058
Thermonuclear processes, I.E.E. convention on, by C. P. Haigh, 851
Thorn Electrical Industries: Pension scheme, 182; Agreement with Philco International Corporation, 266; Works visit, 317
Thorpe Marsh power station, Pump motors for, 957
Three-phase system harmonics, by A. G. Powell, 149
Tidal forces, Plan to harness, 566
Tinning plant, Polish order for, 1102
Token import scheme, 21
Torque convertor, Variable-ratio, by D. O. Bishop and G. S. Brosan, 777
Trade talks, "Outer Seven" countries, 1058
Trade unions, Women and, 863
Train indicator installation, 120
Training college kitchen installation, 268
Tramways: Abandonment of Glasgow, 59; Working museum project, 954
Transatlantic telephone cable: Fault in, 397, 438; Developments, 438; Order for third, 489; Laying of second —— begun, 553
Transformer insulation levels, by G. B. Harper, 587
Transformer laminations, Furnace for heat treatment of, 522
Transformer noise research, Sound testing chamber for, 1100
Transformers: American contract, 20; Indian manufacture of, 104; South African order for, 317; Tasmanian order for, 452; —— for India, 453, 954; Singapore contract, 729; Mobile mining, 853; Buried type, 911; New Zealand order, 913; —— for Berkeley nuclear power station, 1145
Transhipment open general licence, 403
Transistors: —— for communication equipment, by H. T. Prior, D. J. R. Chapman and A. A. M. Whitehead, 127; International Convention and Exhibition, 299, 938, 1010, 1045; British —— applications, by T. D. Towers, 362; —— and semiconductor devices, by I. G. Cressell, 1045
Translation service, 182
Translations Bulletins, 156
Transmission line accessories factory, 308
Transmission lines: Hawkesbury River (N.S.W.), 29; Damage by birds to, 151; Bahamas project, 222; Youths to pay compensation for damage to, 317; Cost of, 321; Northfleet-Canterbury, 413; West Thurrock Thames crossing, 529; Penrith-Alston, 529; Rhodesian, 648; Bosporus crossing, 686; —— on farms, 746; Elstree-Finchley project, 820; Kent supergrid, 910; High-voltage Arctic, 1162
Transmission towers, Revised rental payments for, 907
Transport Age, 122
Transport of energy, 927, 1022
Travel agency, Electrical, 69
Trawsfynydd nuclear power station project, 1148
Trinidad and Tobago Electricity Commission's annual report, 303
Trolley-buses: Replacement of London, 140, 232, 361; Bradford extension, 271
Truck, Driverless, 827
"Try it Yourself" exhibition, 609
Tubular turbines, 2; by P. Misson, 1081
Tunnel project, Clyde: Compressed air installation for, 348; Road heating for approaches to, 865
Turbines: Tubular, 2; The hydraulic —— in evolution, by Monsieur P. Danel, 38; Tubular, by P. Misson, 1081; New Hawker Siddeley company, 1101
Turbo-alternators: American order for large, 485, 489; Method of determining stresses in rotors of, by Dr. H. Fessler, 759
Turbo-generator excitation, by T. H. Mason, F. H. Birch and Dr. P. D. Aylett, 290, 309
Turkey: Bosporus transmission line crossing, 686

UGANDA Electricity Board: 1958 output figures, 129; Brochure in native language, 649; Revised tariffs, 746; Owen Falls power station, 864; Training scheme, 950; Annual report, 1161
Ultra-sound image camera, 353
Underground gasification tests: End of, 250, 972; Description of, 987
Underground hydro-electric stations, by B. K. R. Prasad, 77
Underground railway: Proposed Victoria line, 301, 321, 462, 614, 1147; Report on train fire, 313, 334; Equipment contracts, 359; New Notting Hill Gate station opened, 434; Buenos Aires extension project, 621; Improved station lighting for, 701; Modernisation scheme, 818
UNESCO: New publication, 67
United Kingdom Atomic Energy Authority: Springfields factory, 233; Changes in organisation of, 612; International Samples Fair exhibit, 729
United States: Plant for, 119, 314, 358, 450, 485, 489, 614; British tenders rejected, 163, 186, 231, 244, 262; Atomic heat storage project, 219; Selling electric fires in, 267; Objections to British orders, 358, 424, 472, 522, 580, 612, 614; Tennessee Valley Authority turbine troubles, 403; Los Angeles plant contract, 450; Measurement research, 461; Large British turbo-alternator for, 485, 489, 614, 1050; Foreign plant in, 522; Electrical industry setback, 538; Labour costs in —— contracts, 612; British hydro-electric equipment tenders, 685, 911; Technical training in, by K. R. Sturley, 717; Electric car competition, 721; O.E.E.C. report on industrial design in, 744; British Exhibition in New York, 825; Electric motors for, 1101; Ruling on imports of turbines, 1147; Pole erection by helicopter, 1162
Unsafe premises, by F. E. Sugden, 442
Uranium: Possibility of private production of, 186; Springfields processing factory, 233

VACUUM-MELTED metals, 877
Vacuum plant: Drying, 20; Valve processing, 609
Valve processing, Vacuum plant for, 609
"Vanguard" aircraft, Electrical power system of the, 244, 248
Variable-ratio torque convertor, by D. O. Bishop and G. S. Brosan, 777
Venezuela: Transformers for, 350; Circuit-breakers for, 404
Veritys: Winding-up petition, 94, 135, 375
Victoria tube line, Proposed, 301, 321, 462, 614, 1147
Volta River hydro-electric project, 756, 795
Voltage regulators: Belgian order, 119; Moving coil, 405

WAGES: Electricity supply industry, 48, 163, 728, 863; Engineering workers', 789, 825; Cable makers', 954; Electricians', 1102
Wages Councils (Amendment) Bill, 262
Wairakei geothermal power project, 566
Wandleside Cable Works, Annual staff dinner of, 24
Warning system, Crane approach, 22
Wash boilers, Survey of, 456
Washing machines, Survey of domestic, 272, 359
Waveguide transmission, Convention on, 364
Wave tubes, klystrons and resonators, Papers on, 410
Weir Committee's report, 624, 633, 635, 656
Weld pre-heating equipment, 69
Welded aluminium tube, Production of, 533
Welded seams, Equipment for radiographic examination of, 686
Welding machine, Self-propelled twin-fillet, 315
Welsh technical information service, 789
Westool sales conference, 1153
Whitworth Fellowships, 787
Wholesale prices: —— in 1958, 450; B.O.T. index number for, 788
Wholesalers: "Self-service" branch opened, 641; Firm's diamond jubilee, 727; German visit, 912
Willesden Technical College silver jubilee exhibition, 267
Windings, Aluminium foil and strip for electrical, by J. J. Lee, 667, 826
Window display competitions, 21, 825
Windscale, New research reactor for, 303
Winfrith Heath nuclear reactor project, 353, 361, 642
Winter Trading Co., New premises of, 1146
Wire manufacturers' centenary, 1056
Wire, sheet and strip sizes, B.S.I. committee's decisions on, 162
Wiring: Faulty —— and the law, by F. E. Sugden, 76; "Easy-purchase" suggestion, 1080
Wiring Regulations interpretations, 1099
Woking power station, Closure of, 937
Women in engineering, I.E.E. discussion on, 697
Wood-pulp mill, Chemical process, 404
Works supply change-over, 640
World Bank: Loans, 43; The ——, by P. J. Squire, 1012
World electrical imports chart, *facing* p. 196
World trade in electrical goods, 196
Worshipful Company of Tin Plate Workers: Essay competition awards, 439

X-RAY conference, 1012

YEAR ahead, The, 1
Yorkshire Electricity Board: Window display competition, 21; Excess voltage complaint, 391; Tariff changes, 565; Transmission lines on farms, 746; Overhead line stolen, 1053

ZIRCONIUM production, 81

Published by ELECTRICAL REVIEW PUBLICATIONS LTD., at Dorset House, Stamford Street, London, S.E.1
and printed in Great Britain at THE CHAPEL RIVER PRESS, Andover, Hants.